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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N76-30147*+ National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 72, JULY 1976
Jul. 1976 66 p
(NASA-SP-7037(72)) Avail: NTIS HC $4.00 CSCL 01A

This bibliography lists 184 reports, articles, and other documents introduced into the NASA scientific and technical information system in June 1976. Author

N76-30148*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PREDICTED DYNAMIC CHARACTERISTICS OF THE XV-15 TILTING PROPROTOR AIRCRAFT IN FLIGHT AND IN THE 40- BY 80-FT. WIND TUNNEL
Wayne Johnson Jun. 1976 56 p refs
(NASA-TM-X-73158; A-6700) Avail: NTIS HC $4.50 CSCL 01A

Pretest predictions of the dynamic characteristics of the XV-15 tilting proprotor aircraft are presented. The data for the aircraft in flight include: trim conditions, flight dynamics, gust response, aeroelastic stability and the wing response to control. The data for the aircraft in the Ames 40- by 80-ft wind tunnel include aeroelastic stability and the wing response to control. The calculations were made for pylon tilt angles of 0 deg (airplane mode), 0.1 deg (pylon unlocked), 30, 60, and 90 deg (helicopter mode). Author

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N76-30149 Ohio State Univ., Columbus.
SUBSONIC AND TRANSONIC FLOW OVER SHARP AND ROUND NOSED NONLIFTING AIRFOILS Ph.D. Thesis
James Joseph Olsen 1976 154 p
Avail: Univ. Microfilms Order No. 76-18017

A theoretical and numerical investigation was conducted of the solution of the equations which govern the subsonic and transonic flow of a perfect gas over sharp and round nosed nonlifting airfoils. The investigation was prompted by disagreements among three sources of airfoil pressure distributions: experiment, analytical solutions, and numerical finite-difference solutions of the first order equations. The investigation showed that commonly presented numerical solutions seem to agree with experiment but not with analytical solutions. It was shown that the numerical solutions can be brought into agreement with the analytical solutions by very careful attention to the airfoil nose singularities; however, the consistent analytical and numerical solutions then disagreed with experiment. Dissert. Abstr.

N76-30150 Stanford Univ., Calif.
PRESSURE FLUCTUATIONS ON THE SURFACE OF A CYLINDER IN UNIFORM FLOW Ph.D. Thesis
Alfred Ayoub 1976 121 p
Avail: Univ. Microfilms Order No. 76-18745

A theoretical approach to the problem of the unsteady loading experienced by a cylindrical body in uniform cross-flow, as a result of the fluctuating wake behind it, is presented. It is based on the general equations of motion which, under the assumption of incompressibility, reduce to a linear equation for the pressure whose forcing term depends on the velocity field alone. It is further assumed that the flow is homogeneous in a direction along the cylinder axis. This reduces the problem to one in two dimensions for the Fourier components of the fluctuating pressure field. The resulting equation is then integrated formally using an appropriate Green's function. It is shown that for the case of a circular cross-section, the free-space Green's function alone is sufficient for obtaining closed form expressions for the fluctuating lift and drag in terms of the velocity field in the near-wake. Dissert. Abstr.

N76-30151 Washington Univ., Seattle.
TRANSITION TO TRANSONIC FLOW IN THE FAR FIELD FOR A SUPERSONIC AIRFOIL IN A STRATIFIED ATMOSPHERE Ph.D. Thesis
George Albert Pechuzal 1975 116 p
Avail: Univ. Microfilms Order No. 76-17588

The flow field due to a thin airfoil in an atmosphere with a weak wind gradient is examined. Because of this wind gradient, which is assumed to increase linearly with altitude, the flow gradually becomes transonic in the far field below the airfoil. This transition phenomenon also occurs in an atmosphere where the temperature decreases with altitude, and for certain cases of accelerating flights. It is shown that a solution which describes both supersonic and transonic regimes can be derived by matching two expansions. The flow field in the transonic region is then calculated numerically using the method of characteristics and incorporating the appropriate shock relations. The problem considered here is restricted to be strictly hyperbolic by introducing a horizontal boundary, the ground, at an appropriate distance from the airfoil such that the lowest Mach number in the flow is strictly greater than one. In addition to mapping the flow field in the transonic region, the numerical solution is used to confirm the validity of the proposed asymptotic results. Dissert. Abstr.

N76-30152 Georgia Inst. of Tech., Atlanta.
UNSTEADY DRAG AND DYNAMIC STALL AS SIMULATED IN A VARYING FREESTREAM Ph.D. Thesis
Donald Lee Kunz 1976 189 p
Avail: Univ. Microfilms Order No. 76-16984

The low turbulence wind tunnel, equipped with an axial gust generator, was employed to simulate the aerodynamic environment of a helicopter rotor blade for two different phenomena. It was

used to study the dynamic stall of a pitching blade, and the in plane oscillations of a rotor blade on a hovering helicopter. Simple harmonic velocity perturbations in the freestream affect dynamic stall and unsteady drag were investigated. The data taken in the harmonically varying freestream were then compared to constant freestream data, and to the results of two analytical methods; one based on potential flow theory, and the other an empirical method. These comparisons showed that, under the conditions tested, the velocity perturbations had a significant effect on the pitching moment which could not be consistently predicted by the analytical methods. Dissert. Abstr.

N76-30153 Tennessee Technological Univ., Cookeville.
SUPERSONIC TWO-PHASE FLOW PAST CONES AND SPHERES Ph.D. Thesis
Chung-Hsein Lyu 1974 94 p
Avail: Univ. Microfilms Order No. 76-17271

An analysis of the motion of small particles in a supersonic shock layer is described. It is assumed the mass fraction of the particles is small. The governing differential equations associated with a continuum theory of the motion of air-particle suspensions are solved for the case of supersonic flow over wedges, right circular cones at zero angle of attack, and past spheres and cylinders. Both approximate analytical solutions valid for thin shock layers and exact numerical solutions are obtained for the particle-phase flow variables. Results useful in estimating the extent of cratering and erosion damage to high-speed vehicles flying in the atmosphere are displayed graphically and employed to illustrate interesting features of two-phase flows past conical and blunt bodies. The importance of nonnegligible particle-phase volume fractions and distributions of particle sizes within the mixture are also discussed. Dissert. Abstr.

N76-30154*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC PERFORMANCE STUDIES FOR SUPERSONIC CRUISE AIRCRAFT
Vincent R. Mascitti May 1976 21 p refs
(NASA-TM-X-73915) Avail: NTIS HC $3.50 CSCL 01A

Technical progress made in each of the disciplinary research areas affecting the design of supersonic cruise aircraft is discussed. The NASA Supersonic Cruise Aircraft Research program has supported an expanded research program in aerodynamics including an ever growing experimental data base, methodology development across the Mach number range, and sonic boom. Progress in the aerodynamics area could facilitate the choice of the highly swept subsonic leading edge, arrow wing, known for superior supersonic cruise efficiency. Author

N76-30155*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BOUNDARY LAYER THICKNESS EFFECT ON BOATTAIL DRAG
B. J. Blaha, R. Chamberlain, and L. J. Bober 1976 23 p refs Presented at the 12th Propulsion Conf., Palo Alto, Calif., 26-29 Jul. 1976; sponsored by AIAA, and SAE
(NASA-TM-X-73443; E-8797) Avail: NTIS HC $3.50 CSCL 01A

A combined experimental and analytical program was conducted to investigate the effects of boundary layer changes on the flow over high angle boattail nozzles. The tests were run on an isolated axisymmetric sting mounted model. Various boattail geometries were investigated at high subsonic speeds over a range of boundary layer thicknesses. In general, boundary layer effects were small at speeds up to Mach 0.8. However, at higher speeds significant regions of separated flow were present on the boattail. When separation was present large reductions in boattail drag resulted with increasing boundary layer thickness. The analysis predicts both of these trends. Author

N76-30156*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF EXTERNAL JET-FLOW DEFLECTOR GEOMETRY ON OTW AERO-ACOUSTIC CHARACTERISTICS
U. VonGlahn and D. Groesbeck 1976 33 p refs Presented at the 3d Aero-Acoustics Conf., Palo Alto, Calif., 20-23 Jul. 1976; sponsored by AIAA
(NASA-TM-X-73460; E-8823) Avail: NTIS HC $4.00 CSCL 01A

The effect of geometry variations in the design of external deflectors for use with over-the-wing (OTW) configurations was studied at model scale and subsonic jet velocities. Included in the variations were deflector size and angle as well as wing size and flap setting. A conical nozzle (5.2-cm diameter) mounted at 0.1 chord above and downstream of the wing leading edges was used. The data indicate that external deflectors provide satisfactory takeoff and approach aerodynamic performance and acoustic characteristics for OTW configurations. These characteristics together with expected good cruise aerodynamics, since external deflectors are storable, may provide optimum OTW design configurations. Author

N76-30157*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.
AN INVESTIGATION OF AEROELASTIC PHENOMENA ASSOCIATED WITH AN OBLIQUE WINGED AIRCRAFT Final Technical Report
Terry A. Weisshaar 31 Aug. 1976 44 p refs
(Grant NsG-2016)
(NASA-CR-148723) Avail: NTIS HC $4.00 CSCL 01A

Oblique wing aeroelasticity studies are reviewed. The static aeroelastic stability characteristics of oblique wing aircraft, lateral trim requirements for 1-g flight, and the dynamic aeroelastic stability behavior of oblique winged aircraft, primarily flutter, are among the topics studied. The similarities and differences between oblique winged aircraft and conventional, bilaterally symmetric, swept wing aircraft are emphasized. Author

N76-30158*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PREDICTION OF STATIC AERODYNAMIC CHARACTERISTICS FOR SLENDER BODIES ALONE AND WITH LIFTING SURFACES TO VERY HIGH ANGLES OF ATTACK
Leland Howard Jorgensen Jul. 1976 264 p refs
(NASA-TM-X-73123; A-6541) Avail: NTIS HC $9.00 CSCL 01A

An engineering-type method is presented for computing normal-force and pitching-moment coefficients for slender bodies of circular and noncircular cross section alone and with lifting surfaces. In this method, a semi-empirical term representing viscous-separation crossflow is added to a term representing potential-theory crossflow. For many bodies of revolution, computed aerodynamic characteristics are shown to agree with measured results for investigated free-stream Mach numbers from 0.6 to 2.9. For several bodies of elliptic cross section, measured results are also predicted reasonably well over the investigated Mach number range from 0.6 to 2.0 and at angles of attack from 0 to 60 deg. As for the bodies of revolution, the predictions are best for supersonic Mach numbers. For body-wing and body-wing-tail configurations with wings of aspect ratios 3 and 4, measured normal-force coefficients and centers are predicted reasonably well at the upper test Mach number of 2.0. However, with a decrease in Mach number to 0.6, the agreement for C sub N rapidly deteriorates, although the normal-force centers remain in close agreement. Vapor-screen and oil-flow pictures are shown for many body, body-wing, and body-wing-tail configurations. When separation and vortex patterns are asymmetric, undesirable side forces are measured for the models even at zero sideslip angle. Generally, the side-force coefficients decrease or vanish with the following: increase in Mach number, decrease in nose fineness ratio, change from sharp to blunt nose, and flattening of body cross section (particularly the body nose). Author

N76-30159*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AERODYNAMIC CHARACTERISTICS OF AN A-4B AIRCRAFT WITH SIMULATED AND ACTUAL GUNFIRE DAMAGE TO ONE WING
Mark D. Betzina and David H. Brown Jul. 1976 174 p Prepared in cooperation with US Army Air Mobility R and D Lab.
(NASA-TM-X-73119; A-6519) Avail: NTIS HC $6.75 CSCL 01A

The aerodynamic characteristics of a damaged McDonnell Douglas A-4B aircraft were studied in the Ames Research Center's 40- by 80-Foot Wind Tunnel. A standard fuselage and three

different wings were used. The first wing tested was an undamaged one in which holes had been cut and detachable cover plates installed. Removal of one or more cover plates gave one of fourteen different simulated damage cases. The other two wings tested were damaged by actual gunfire at an Air Force range. Author

N76-30160*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AIRCRAFT MOTION AND PASSENGER COMFORT RESPONSE DATA FROM TIFS RIDE-QUALITY FLIGHT EXPERIMENTS
W. Elliott Schoonover, Jr. Aug. 1976 139 p
(NASA-TM-X-73944) Avail: NTIS HC $6.00 CSCL 01A

The aircraft motion data and passenger comfort response data obtained during ride-quality flight experiments using the USAD Total In-Flight Simulator (TIFS) are given. During each of 40 test flights, 10 passenger subjects individually assessed the ride comfort of various types of aircraft motions. The 115 individuals who served as passenger subjects were selected to be representative of air travelers in general. Aircraft motions tested consisted of both random and sinusoidal oscillations in various combinations of five degrees of freedom (transverse, normal, roll, pitch, and yaw), as well as of terminal-area flight maneuvers. The data are sufficiently detailed to allow analysis of passenger reactions to flight environments, evaluation of the use of a portable environment measuring/recording system and comparison of the in-flight simulator responses with input commands. Author

N76-30161*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF TEST IA137 IN THE NASA/ARC 14 FOOT TRANSONIC WIND TUNNEL OF THE 0.07 SCALE EXTERNAL TANK FOREBODY (MODEL 68-T) TO DETERMINE AUXILIARY AERODYNAMIC DATA SYSTEM FEASIBILITY
D. E. Thornton (Rockwell Intern., Downey, Calif.) Aug. 1976 560 p
(Contract NAS9-13247)
(NASA-CR-147622; DMS-DR-2316) Avail: NTIS HC $13.50 CSCL 01A

Tests were conducted in a 14 foot transonic wind tunnel to examine the feasibility of the auxiliary aerodynamic data system (AADS) for determining angles of attack and sideslip during boost flight. The model used was a 0.07 scale replica of the external tank forebody consisting of the nose portion and a 60 inch (full scale) cylindrical section of the ogive cylinder tangency point. The model terminated in a blunt base with a 320.0 inch diameter at external tank (ET) station 1120.37. Pressure data were obtained from five pressure orifices (one total and four statics) on the nose probe, and sixteen surface static pressure orifices along the ET forebody. Author

N76-30162# Naval Surface Weapons Center, White Oak, Md.
HANDBOOK OF INVISCID SPHERE-CONE FLOW FIELDS AND PRESSURE DISTRIBUTIONS, VOLUME 1
A. M. Morrison, M. Ciment, J. M. Solomon, and R. E. Ferguson 1 Dec. 1975 569 p refs
(SF3232250)
(AD-A021960; NSWC/WOL/TR-75-45-Vol-1) Avail: NTIS CSCL 20/4

Numerical tables of aerodynamic coefficients and surface pressure distributions for sphere cone configurations as a function of angle of attack and Mach number are studied. Results were generated by a computer code based on a finite difference solution of the steady inviscid three dimensional compressible flow equation for a perfect gas. Cone half angles are considered. Truncated values are obtained at axial stations to a length of 200 times the sphere radius, over a Mach number range of 3.5, 5, 10, 15, 20, 25 and 30, for an angle of attack span of 1, 3, 5, and 10 degrees. Center of pressure location, and axial and normal force coefficients are tabularly presented at each axial length increment station. Surface pressure distributions are also presented at each axial length increment station. GRA

N76-30163# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
ACOUSTIC MEASUREMENT OF THE CIRCULATION OF VORTICES AND THE CIRCULATION DISTRIBUTIONS IN WIND TUNNEL MODEL INVESTIGATIONS
D. W. Schmidt 1975 107 p refs In GERMAN; ENGLISH summary
(MPIS-Mitt-61) Avail: NTIS HC $5.50; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 25

Simple method for direct measurement of the circulation of vortices was deduced based on the influence of a vortex on the running time of ultrasonic pulses in flows and an acoustic circulation meter using this method developed. This instrument was tested by performing measurements in the flow around models of a rectangular wing and of a swept wing in a 3 m x 3 m wind tunnel at velocities up to 30 m/s. Using the rectangular wing, measurements of the dependence of the circulation on the angle of incidence of the wing and on the main flow velocity and, further, of the circulation distribution along the wing span were made; using the swept wing, the tip vortex was measured. The results of measurements proved, to be independent of practically all disturbing influences. The smallest values of measured circulation were about 0.1 sqm/s. It is advantageous that the flow region under test is not disturbed by measuring probes, and that measuring times are short. Thus, the time needed to measure a circulation distribution depends only on the time needed to position the microphone system which is mounted on the traversing apparatus of the wind tunnel. Author (ESA)

N76-30164# National Aerospace Lab., Amsterdam (Netherlands). Div. Fluid Dynamics.
IMPROVED NOZZLE TESTING TECHNIQUES IN TRANSONIC FLOW. RESULTS OF NLR CONTRIBUTION TO AGARD AD-HOC STUDY
D. Rozendal, C. C. Groothoff, and W. B. G. Derksen Feb. 1975 84 p refs Submitted for publication
(NLR-MP-75007-U) Avail: NTIS HC $5.00

A description is given of a series of experiments in order to assess the influence of jet exhaust parameters - total pressure distortion, nozzle pressure ratio, jet temperature (ratio of specific heats) - at transonic Mach numbers in the range of 0.8 to 0.96 on the nozzle thrust and discharge coefficients, on the afterbody pressure distribution, and on the afterbody pressure drag. A method was developed to define a valid total pressure, based on a mass flow averaging procedure, for a distorted jet pipe flow. The results for the AGARD nozzle, contraction ratio 3.24, show that in the investigated range of NPR's there is only a small effect due to the jet pipe total pressure distortion, while for the larger nozzle with a contraction ratio of 1.62 the hollow velocity profile, compared to a flat profile, significantly lowered the nozzle discharge coefficient (3.2%), raised the specific thrust + 2.1% and changed the afterbody pressure distribution at M infinity = 0.8. Effects on afterbody pressure distribution and pressure drag due to different NPR and M infinity were evident, while an influence due to fuselage boundary layer thickness is indicated. Furthermore it was found that boattail surface temperature significantly affects the boattail pressure distribution. For the hot jet tests the jet temperature effects on the nozzle characteristics were of minor importance, while the jet temperature effects on the boattail pressures could not be separated from the surface temperature effect. Author (ESA)

N76-30165# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany). Inst. fuer Turbulenzforschung.
TURBULENT PRESSURE DATA RELEVANT TO AIRFRAME NOISE SOURCES
Helmut V. Fuchs 19 Jan. 1976 26 p refs
(DLR-FB-76-09) Avail: NTIS HC $4.00; DFVLR, Cologne DM 11,30

Estimates of sound radiated from rigid surfaces interacting with a turbulent flow require a knowledge of, at least, the rms pressure fluctuation level p and the size of the respective correlation areas on the surface under consideration. Since there is considerably more information available on velocity fluctuations in turbulent flow than there is on corresponding static pressure fluctuations, it is convenient to replace p by an equivalent velocity expression. It is shown that this assumption can result in misleading estimates of the relative importance of the various air frame noise source components. The value of the dimensionless pressure coefficient varies from 1 to 1,000

depending on the local turbulence level and the particular flow configuration considered. Author (ESA)

N76-30166# Walz (Alfred), Emmendingen (West Germany).
THEORY AND PRACTICAL COMPUTATION OF THREE-DIMENSIONAL FLOW AND TEMPERATURE FIELDS [BEITRAG ZUR THEORIE UND PRAKTISCHEN BERECHNUNG DREIDIMENSIONALER STROEMUNGS- UND TEMPERATURFELDER]
Bonn DOKZENTBw 1975 69 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVg-FBWT-75-22) Avail: NTIS HC $4.50; DOKZENTBw DM 30

Results of preparatory work on the economic solution of the general aerodynamic problem of three-dimensional flow around a lifting body are reported. Present and future research is outlined as follows: evaluation of the interaction between separated flow and adjacent boundary layer flow, and computability of transition and turbulence phenomena in the boundary layer and in free shear layers. The possibility of future production of a practical economic approximation theory was investigated. ESA

N76-30167# Dornier-System G.m.b.H., Friedrichshafen (West Germany).
CALCULATION OF SUBSONIC AND HYPERSONIC FLOWS USING POTENTIAL THEORY [POTENTIALTHEORETISCHE BERECHNUNGSVERFAHREN FUER UNTER- UND UEBERSCHALLSTROEMUNGEN]
W. Schmidt Bonn DOKZENTBw 1975 67 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVg-FBWT-75-23) Avail: NTIS HC $4.50; DOKZENTBw DM 30

An attempt is made to show the basic ideas which led to the different known three-dimensional panel methods in steady three-dimensional subsonic and supersonic potential flow. A critical review of the various assumptions used in the different methods is done partially using series expansions of the exact solutions. Based on such expansions a higher order panel method can be derived which avoids the main disadvantages of the present methods. Author (ESA)

N76-30168# Institut Franco-Allemand de Recherches, St. Louis (France).
UNSTEADY TRANSONIC SUPERSONIC FLOW OVER SUDDENLY INSERTED BODIES
W. Frank (Karlsruhe Univ., West Ger.), G. Patz, and J. Zierep (Karlsruhe Univ., West Ger.) 24 Sep. 1975 11 p refs Presented at the symp. Transsonicum, Goettingen, West Ger., 8-13 Sep. 1975
(ISL-CO-210/75) Avail: NTIS HC $3.50

A shock wave develops at the tip of the generated profile if a source distribution is instantaneously inserted in a parallel transonic supersonic flow. Usually this shock wave detaches and moves upstream to a position which belongs to the steady state solution. This flow field was investigated in a transonic wind tunnel and in a shock tube for the two-dimensional and the axisymmetric case. The experimental results for the time dependent stand-off distance of the shock wave are compared with theoretical considerations. For moderate stand-off distances the agreement between theory and experiment is very good. Further, it was of interest to find out whether the freezing of the transonic flow is saved behind the moving shock wave, as this is a basic assumption of the theory. The experiments proved this. Author (ESA)

N76-30169# Cambridge Univ. (England). Dept. of Engineering.
COMPRESSIBLE TURBULENT BOUNDARY LAYERS WITH COMBINED AIR INJECTION AND PRESSURE GRADIENT
G. D. Thomas London Aeron. Res. Council 1976 77 p refs Supersedes ARC-35483
(ARC-R/M-3779; ARC-35483) Avail: NTIS HC $5.00; HMSO £ 5.10; PHI

The effect of longitudinal pressure gradients upon compressible turbulent boundary layers on a flat plate, with and without air injection, was studied. A brief survey of some of the more recent work on pressure gradient flows with and without injection is given. Emphasis is placed upon the effects of the pressure gradients on the velocity and temperature profiles although theoretically predicted developments are indicated on the figures. The use of the razor blade technique for measuring skin friction in pressure gradient flows is also shown to be very satisfactory. Author (ESA)

N76-30170# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
INTERFERENCE PROBLEMS ON WING-FUSELAGE COMBINATIONS IN INVISCID, INCOMPRESSIBLE FLOW
J. Weber and M. GaynorJoyce London Aeron. Res. Council 1976 74 p refs Supersedes RAE-TR-74073; ARC-35588
(ARC-R/M-3781; RAE-TR-74073; ARC-35588) Avail: NTIS HC $4.50; HMSO £ 4.50; PHI

Some interference effects between fuselage and wing are studied for two classes of configurations. For the first class the report deals with the change of the pressure distribution caused by the body interference, and, for the second class, with the change of the required shape of the mean surface. The problems are solved by considering first the flow field past a single kinked infinite swept source line or a vortex, in the presence of the fuselage, and by computing some velocity components. From the tabulated values of these velocity components, the interference velocities for wings of given thickness distribution or load distribution can be derived by chordwise integration. A few examples demonstrate how the interference effects can vary with the angle of sweep, with the ratio between body radius and wing chord and with the spanwise distance from the wing-body junction. Author (ESA)

N76-30171# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
AN ASSESSMENT OF THE IMPORTANCE OF THE RESIDUAL FLEXIBILITY OF NEGLECTED MODES IN THE DYNAMICAL ANALYSIS OF DEFORMABLE AIRCRAFT
A. S. Taylor and M. R. Collyer London Aeron. Res. Council 1976 78 p refs Supersedes RAE-TR-73119; ARC-35085
(ARC-CP-1336; RAE-TR-73119; ARC-35085) Avail: NTIS HC $5.00; HMSO £2.30; PHI

The mathematical framework for a unified approach to the dynamical problems of deformable aircraft is used as the basis for a limited numerical investigation of the usefulness of the residual flexibility concept in truncated modal analyses. A finite element model of a supersonic transport aircraft of slender delta configuration is the subject of stability and response calculations, in which various representations of the structural deformability are used. These comprise up to four natural modes both with and without the residual flexibility of the remaining modes. It is concluded that the addition of residual flexibility to a structural model which comprises only one or two modes significantly improves the accuracy of estimates of low frequency characteristics. However, if a single model is to be used in an integrated approach to the aeroelastic problems of an aircraft, it must incorporate a fairly large number of modes in order to deal with the higher-frequency problems. In these circumstances the residual flexibility concept would seem to have little practical value. Author (ESA)

N76-30172# British Aircraft Corp., Warton (England). Military Aircraft Div.
EVALUATION OF A LOADING FORM FOR THE CALCULATION OF LINEARISED THEORY PRESSURE DISTRIBUTIONS ON WINGS WITH CONTROL SURFACES HAVING SWEPT HINGE LINES IN STEADY SUBSONIC FLOW
T. G. Wigley London Aeron. Res. Council 1976 58 p refs Supersedes ARC-35865
(Contract K43A/421/C.B.43(A)2)
(ARC-CP-1340; ARC-35865) Avail: NTIS HC $4.50; HMSO £2.60; PHI

Partially matched loadings are constructed to enable the accurate simulation of first order boundary conditions on wings with control surfaces having swept hinge lines in subsonic flow. These loadings are assessed by observing the character of the difference between the induced downwash and the required boundary condition, paying special attention to the neighborhoods of hinge line corners. The regularized downwashes are used in lifting surface calculations to provide values for the fully matched loadings. Author (ESA)

N76-30173# National Aerospace Lab., Amsterdam (Netherlands).
ANALYSIS OF A STEPWISE NUMERICAL METHOD FOR SOLUTION OF A THREE-DIMENSIONAL FLOW PROBLEM
Ph.D. Thesis - Twente Technological Univ., Neth.
C. R. Traas 1975 128 p refs
(NLR-TR-75072-U) Avail: NTIS HC $6.00

The simulation of a class of three-dimensional, stationary, supersonic gas flows by construction of an approximate solution to the governing system of partial differential equations, is analyzed. The investigated method is a hybrid one: it involves finite difference calculations on a regular, orthogonal grid, and characteristics calculations, the latter along the boundaries of the computational region. Alternative boundary treatment methods are studied for comparison. The convergence and stability properties of the used difference scheme are analyzed in depth, and its dispersive and dissipative properties are examined in detail. About the influences that non-linearities may have, a few statements are made. The choice of the applied difference scheme, based originally on empirical evidence from literature, is justified on the basis of a nonlinear analysis. The controversy shock capturing/shock fitting is discussed. Computational examples are given for rather complicated flow patterns, using both approaches. A smoothing method is proposed to suppress an occurring instability. It is proved that the convergence property of the difference approximation is not destroyed when the smoothing technique is applied. An appraisal is given of the used computational method. Author (ESA)

N76-30174# European Space Agency, Paris (France).
VISUALIZATION OF THE SUBSONIC FLOW AROUND TWO SPACE GLIDER CONFIGURATIONS
Hans Bippes et al Mar. 1976 42 p refs Transl. into ENGLISH of 'Sichtbarmachung der Umstroemung zweier Raumgleiterkonfigurationen im Unterschallbereich', DFVLR, Goettingen, West Ger. Report DLR-FB-75-49, 16 Jul. 1975 Original German report available from DFVLR, Cologne DM 79.90
(ESA-TT-271; DLR-FB-75-49) Avail: NTIS HC $4.00

The subsonic flow around two delta wing space glider configurations with rounded leading edges and fuselage was made visible in a water towing basin by means of the hydrogen bubble technique for different angles of attack and yaw with Re numbers ranging from 0.03 million to 1.2 million. The models were designed by the Reentry Technology Working Group (Arbeitsgemeinschaft Rueckkehrtechnologie). Special attention was devoted to the observation of the development of the leading edge and body vortices and to their interaction on the stabilizer flow, to leading edge vortex burst, and to flow separation and turbulence generation. The relevant three-dimensional flow phenomena were recorded by stereo photographs and are reproduced in print as anaglyphs (double-color pictures available only with original German language report). Author (ESA)

N76-30175# European Space Agency, Paris (France).
EXPERIMENTAL INVESTIGATION CONCERNING THE REDUCTION OF WAVE DRAG OF POINTED SYMMETRICAL WINGS OF EQUAL VOLUME WITH SUBSONIC LEADING EDGE AND BELL-SHAPED PLANFORM FOR DIFFERENT THICKNESS DISTRIBUTIONS IN THE SPANWISE AND CHORDWISE DIRECTIONS
Friedrich Keune et al Feb. 1976 36 p refs Transl. into ENGLISH of 'Exptl. Untersuch. zur Verringerung des Wellenwiderstands vorn spitzer symmetrischer Fluegel gleichen Volumens mit Unterschallvorderkante u. glockenfoermiger Grundrissform bei verschiedenen Dickenverteilungen in Spannweiten- u. Tiefenrichtung', DFVLR, Cologne Report DLR-FB-75-62, 15 Sep. 1975 Original German report available from DFVLR, Cologne DM 15.40
(ESA-TT-269; DLR-FB-75-62) Avail: NTIS HC $4.00

For comparison with a theory developed by F. Keune drag measurements were carried out on a family of wings in test section A sub H of the 30 x 30 sq cm supersonic wind tunnel of the DFVLR in Porz-Wahn for the Mach number range 1.57 to 4.15. The feasibility of the zero lift wave drag reduction for pointed symmetrical wings of finite thickness and equal volume by variation of the wing planform and of the thickness distribution in the spanwise and chordwise directions was studied. Because of the unavoidable influence of the model support and the approximate estimate only of the skin friction necessary for determining the wave drag, no agreement was found with the theory, which is valid for the wave drag of wings only; however, from the flow behavior observed during the tests it was obvious that the shock wave-boundary layer interaction was important. In addition to the drag measurement other important aerodynamic coefficients were experimentally determined for small angles of incidence. Author (ESA)

N76-30176# Institute for Defense Analyses, Arlington, Va. Science and Technology Div
ANALYSIS OF BOUNDARY LAYER IMPACT TRANSITION EFFECTS ON BALLISTIC REENTRY VEHICLE DISPERSION AND COMPARISON WITH OTHER DISPERSION FACTORS
Final Report, May - Dec. 1975
H. P. Liepman Dec. 1975 61 p refs
(Contract DAHC15-73-C-0200)
(AD-A022949; P-1137; IDA/HQ-75-17634) Avail: NTIS CSCL 16/3

This paper analyzes the impact dispersion of a ballistic reentry vehicle caused by the transitory lift and drag components encountered during the brief altitude regime where the vehicle's boundary layer is changing from laminar to turbulent behavior. A simple physical model of the phenomenon is developed using adjustable parameters since the basic aerothermal materials physics is poorly understood. The adjustable parameters are identifiable with physical assumptions and one result is to focus attention on the nature of these assumptions in order to guide further theoretical and experimental work which can develop a better understanding of the phenomenon, particularly its impact on materials and structures technology. Under the assumptions made, numerical estimates are made of the boundary layer transition dispersion for a practical range of vehicle and trajectory parameters, and then compared with contributions from density, wind velocity, and drag variations and from the roll-through-zero effect. The boundary layer effects are found to be too large to be ignored and further studies are needed to bound the behavior. Additional studies of the Materials and Structures Technology Base Programs related reentry vehicle mission requirements will be made in a subsequent paper. Author (GRA)

N76-30177# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN EXPERIMENTAL INVESTIGATION OF THE PRESSURE FIELD AROUND A THRUST VECTOR CONTROL DEVICE M.S. Thesis
Glenn B. Russell Dec. 1975 95 p refs
(AD-A021875; GAE/AE/75D-17) Avail: NTIS CSCL 01/3

An experimental investigation was conducted to determine the interaction of a thrust vector control device, employing the Coanda effect, on an exhaust jet issuing from a round convergent nozzle. The thrust vector device consisted of a curved surface which the jet attached to, and sideplates on each side of this surface. Opening control ports in the surface to ambient conditions caused the jet to detach from the surface. Test positions of the thrust vector device were 6, 9, and 12 degrees surface angle, 0.00 to 0.73 inches axial distance, and 0.00 to 0.40 inches radial distance. The best operation of the device occurred with a gap present between the surface of the device and the nozzle. This allowed the exhaust jet to pump entrained secondary air over the device's surface, creating a negative pressure distribution over the surface. A position with no gap present restricted the entrainment and pumping of secondary air, causing a portion of the exhaust jet to separate from the main airstream and form a separate core of air flowing over the surface. This separation resulted in a degradation of performance (lift and drag). The effects of surface angle, axial displacement, and radial displacement on the exhaust jet were found to be interrelated, and must all be considered together to find the optimum operating position of the device. GRA

N76-30178# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN EXPERIMENTAL INVESTIGATION OF MODEL PARACHUTES UNDER FINITE MASS CONDITIONS M.S. Thesis
H. R. Brown Dec. 1975 96 p refs
(AD-A021877; GAE/AE/75D-9) Avail: NTIS CSCL 01/3

A two part experimental investigation was undertaken. The first part was to develop testing techniques for a finite mass

test fixture. The test fixture is designed such that a model parachute and load are free to move along a wire track through a wind tunnel test section. Also a servomechanism simulated the component of force due to gravity acting on the load. The second part was to test the feasibility of using mass ratios as similarity parameters for wind tunnel testing of model parachutes. Tests were conducted to determine the friction force of the wire track on the test load of varying weights and for varying degrees of lubrication. Graphite lubrication of the wire track reduced the friction force; and adjustments to the servomechanism were developed which compensate for this reduced friction force. GRA

N76-30179# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
A SYSTEM FOR INFLATING A BALLOON USING HELIUM STORED IN THE LIQUID PHASE Final Scientific Report, 15 May 1974 - 31 Aug. 1975
C. F. Sindt and W. R. Parrish Jan. 1976 39 p refs
(AD-A021904; NBSIR-76-834; AFCRL-TR-76-0012) Avail: NTIS CSCL 01/3

This report covers the design and development of the prototype of a system to be used to fill a balloon that has been launched from an aircraft. The described system uses a hot packed bed heat exchanger to gasify 45.4 kg of liquid helium and warm the gas to 260 K for filling the balloon. The prototype system was successfully demonstrated on the ground by filling an ambient pressure balloon with 300 cum of helium gas at an average temperature of 260 K in six minutes and 45 seconds. Author (GRA)

N76-30180# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A STUDY OF AUTOMOTIVE AERODYNAMIC DRAG Final Report, Aug. 1974 - Apr. 1975
Jack E. Marte, Robert W. Weaver, Donald W. Kurtz, and Bain Dayman, Jr. Sep. 1975 82 p refs
(Contract DOT/TSC-RA-74-35-PR612-0248)
(PB-251710/0; DOT-TSC-OST-75-28) Avail: NTIS HC $5.00 CSCL 13F

Reductions of aerodynamic drag in the 20-25% range through the use of several established drag-reduction devices and minor design changes were demonstrated on three large sales-volume 1974 and 1975 model American automobiles. Comparisons of test techniques were made by testing one automobile both full-scale and as a 0.4-scale model in two different wind tunnels. Another vehicle was tested both full-scale in a wind tunnel and by the coast-down technique. Good comparative results were obtained. GRA

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N76-30181*# Tracor, Inc., Austin, Tex.
ANALYSIS OF THE EFFECT OF NUMBERS OF AIRCRAFT OPERATIONS ON COMMUNITY ANNOYANCE Final Report
William K. Connor and Harrold P. Patterson Washington NASA Aug. 1976 92 p refs
(Contract NASw-2774)
(NASA-CR-2741) Avail: NTIS HC $5.00 CSCL 05E

The general validity of the equivalent-energy concept as applied to community annoyance to aircraft noise has been recently questioned by investigators using a peak-dBA concept. Using data previously gathered around nine U.S. airports, empirical tests of both concepts are presented. Results show that annoyance response follows neither concept, that annoyance increases steadily with energy-mean level for constant daily operations and with numbers of operations up to 100-199 per day (then decreases for higher numbers), and that the behavior of certain response descriptors is dependent upon the statistical distributions of numbers and levels. Author

N76-30182*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE PROMISE OF AIR CARGO: SYSTEM ASPECTS AND VEHICLE DESIGN
Allen H. Whitehead, Jr. 19 Jul. 1976 39 p refs
(NASA-TM-X-71981) Avail: NTIS HC $4.00 CSCL 01C

The current operation of the air cargo system is reviewed. An assessment of the future of air cargo is provided by: (1) analyzing statistics and trends, (2) by noting system problems and inefficiencies, (3) by analyzing characteristics of 'air eligible' commodities, and (4) by showing the promise of new technology for future cargo aircraft with significant improvements in costs and efficiency. The following topics are discussed: (1) air cargo demand forecasts; (2) economics of air cargo transport; (3) the integrated air cargo system; (4) evolution of airfreighter design; and (5) the span distributed load concept. Author

N76-30183# McDonnell Aircraft Co., St. Louis, Mo.
INTEGRATED AIRCRAFT FUEL TANK FIRE AND EXPLOSION PROTECTION SYSTEMS, PHASES 1 AND 2 Final Report, 25 Jan. 1974 - 30 Jun. 1975
Q. C. Malmberg 30 Jul. 1975 74 p refs
(Contract F33615-74-C-2008; AF Proj. 3048)
(AD-A020589; MDC-A3601; AFAPL-TR-75-93) Avail: NTIS CSCL 13/12

Aircraft fuel tank fire and explosion protection techniques are described in this two part report which covers both state-of-the-art and advanced concepts. The state-of-the-art section reviews, in handbook form, the fire and explosion protection techniques currently available for immediate aircraft incorporation. These fire protection techniques include open celled flexible foam, closed cell rigid foam, purge mats, and fire extinguishing systems. Both fully packed and voided reticulated foam, nitrogen inerting, fuel fogging, and extinguisher type explosion suppression systems are discussed under the heading of explosion protection techniques. The advanced explosion protection technique section includes descriptions of on-board nitrogen generating concepts and combination systems of foam/nitrogen/fuel-air fog. In addition, the data and results from a small scale test program evaluating the combination type protection concepts is presented. GRA

N76-30184# McDonnell Aircraft Co., St. Louis, Mo.
INVESTIGATION OF AIRCRAFT VOID SPACE FUEL FIRE PHENOMENA Final Report
Q. C. Malmberg Wright-Patterson AFB, Ohio AFAPL 21 Oct. 1975 129 p refs
(Contract F33615-74-C-2008)
(AD-A023485; MDC-A3717; AFAPL-TR-76-3) Avail: NTIS CSCL 01/2

This program was conducted to determine the effects of various system and environmental parameters on the ignition and sustainment of 0.50 cal API projectile induced void space fires. The void space consisted of a 4-inch thick area adjacent to a 20 gallon JP-4 filled fuel tank. In-flight aircraft simulation was accomplished by discharging compressed air over the test specimen moldline skin. Simulated sea level aircraft velocities of 100, 240, and 400 knots were provided. Sustained void space fires were successfully obtained in approximately one fifth of the gun fire tests, however, because of the limited number of repeat tests at any given sustained fire condition, statistical data for repeatability were not generated. The parameters that were tested which influence the combustion in aircraft void spaces include: void space width, skin material types, fuel tank pressure, fuel tank damage configuration, fuel temperature, and threat size/attitude/velocity. The environmental parameters are: external airflow velocity/temperature, external airflow boundary condition (laminar or turbulent), internal airflow rate/temperature. The results indicated that the specimen configuration, and test conditions before and after the projectile impact must be integrated in order to define and quantify the variables and their degree of importance to sustaining void space fires under aircraft inflight conditions and small arms threats. Author (GRA)

N76-30185# Transportation Systems Center, Cambridge, Mass.
SUMMARY OF NATIONAL TRANSPORTATION STATISTICS Final Report, Jan. 1963 - Dec. 1973
William F. Gay Jun. 1975 137 p refs
(PB-252410/6; DOT-TSC-OST-75-18) Avail: NTIS HC $6.00 CSCL 01B

A compendium of selected nation level transportation statistics is reported. Included are cost, inventory, and performance data describing the passenger and cargo operations of the following modes: air carrier, general aviation, automobile, bus, truck, local transit, rail, water, and oil pipeline. Basic descriptors of U.S. transportation, such as operating revenues and expenses, number of vehicles and employees, vehicle miles and passenger miles, etc. are included. GRA

N76-30186# Teledyne/McCormick Selph, Hollister, Calif.
INSTALLATION PROCEDURE OF BACKUP COVERS FOR THE AH-1 CANOPY REMOVAL SYSTEM
Donald R. Duffy 9 Feb. 1976 20 p
(Contract DAAJ01-75-C-0770)
(AD-A021434; USAAVSCOM-TR-75-48) Avail: NTIS CSCL 01/3

This installation procedure was prepared as an aid in installing protective shells, Teledyne McCormick Selph (TMc/S) part number 815478, over damaged Window Cutting Assemblies (WCA) in the AH-1 Helicopter Canopy Removal System. The shells were designed to fit over WCA's with cracked retainers. The segmented shell may be applied over the entire WCA or one or more shell sections may be utilized to cover only the cracked portion of the WCA. A typical shell installation cross section is shown. GRA

N76-30187# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
FLUIDIC THRUST VECTOR CONTROL FOR THE STABILIZATION OF MAN/EJECTION SEAT SYSTEMS Final Report, 16 Dec. 1974 - 1 Jul. 1975
R. B. Beale Oct. 1975 160 p refs
(Contract F33615-75-C-3031; AF Proj. 6065)
(AD-A021223; F0350-FR; AFFDL-TR-75-105) Avail: NTIS CSCL 01/3

A 2-axis, hydrofluidic thrust vector control (TVC) system was designed to improve the total trajectory of an ejection seat system during adverse conditions from 0 to 600 knots air speed. A nonlinear model of the seat was derived and linearized to determine the best hardware components for meeting those requirements. A vortex rate sensor, fluidic resistance-capacitance (rc) compensation and a two stage servovalve, using hot gas pressurized oil were chosen to drive a ball and socket nozzle with 20 degrees of thrust deflection. This system controls seat attitude and rate in the pitch and yaw axes. Of the many operating conditions analysed, the worst case was 70 degrees nose down, -250 degrees/sec pitch rate, 2 inches cg offset in pitch and cg offset in yaw at 0 knots. Recovery heights of 360 and 100 feet are achieved at 0 and 600 knots with a 5000 lb. rocket burning 0.5 sec. By stabilizing the escape system at its aerodynamics trim condition with the drogue chute out during rocket burn, the remainder of the flight remained stable. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N76-30188# National Aviation Facilities Experimental Center, Atlantic City, N.J.
ATC/AIRBONE CAS COMPATIBILITY: AN ANALYSIS OF FIELD-DERIVED DATA Final Report, Sep. 1973 - Dec. 1975
Gordon Jolitz Jun. 1976 78 p refs
(AD-A026070/3; FAA-NA-76-14; FAA-RD-75-228) Avail: NTIS HC $5.00 CSCL 01/2

Realtime simulation experiments were conducted at the National Aviation Facilities Experimental Center (NAFEC) for the purpose of investigating the interface between the Air Traffic Control (ATC) system and a proposed Airborne Collision Avoidance System (ACAS). Based on results of those experiments, it was concluded that: (1) some means of desensitizing the ACAS in the final approach sequencing and spacing zone of busy terminal areas was mandatory, and (2) the concentration of ATC/ACAS interaction would probably vary from site to site. In lieu of further realtime simulation, track history data were recovered from the Washington, Chicago, Los Angeles, and Miami ARTS 3 facilities. After intermediate processing, the digital representation of the traffic flows were inspected by a software model of the ACAS. Results were reduced in the form of alarm rates, before and after desensitization. Results of the analysis confirmed the conclusion that some form of desensitization would be required. It was further concluded that desensitization procedures would not only vary from site to site, but would also be dependent on the runway utilization configuration at a given site. A secondary objective was the development of methodology and software for recovering and reprocessing real world air traffic data such that the end product was a field-derived data bank containing forty-eight 1-hour samples of high density terminal area traffic. Author

N76-30189# National Aviation Facilities Experimental Center, Atlantic City, N.J.
FLIGHT PERFORMANCE AND FLIGHT TESTS OF THE TYPE 1 FLIGHT INSPECTION MONITOR (FIM-1) Interim Report
Nicholas J. Talotta and Paul Todd May 1976 34 p
(AD-A026080/2; FAA-NA-75-63; FAA-RD-76-56) Avail: NTIS HC $4.00 CSCL 01/2

Performance tests were conducted on the Air Traffic Control Radar Beacon System (ATCRBS) type I Flight Inspection Monitor (FIM-I). The FIM-I equipment was then installed on a test aircraft for limited flight testing in the mid-Atlantic states. Software was developed for data reduction and postflight analysis to evaluate the performance of the FIM-I equipment. Laboratory performance tests showed that the equipment met contract specifications. Flight test data showed a deficiency in performance on signals near minimum trigger level sensitivity, but since these were a small percentage of the total data, the interrogation environmental information obtained was eminently useful and informative. Author

N76-30190*# Ohio Univ., Athens. Dept. of Electrical Engineering.
DIGITAL TIME SLOT DISPLAY FOR OMEGA RECEIVER
Ralph E. Smith Jul. 1976 7 p
(Grant NGR-36-009-017)
(NASA-CR-148765; TM-29) Avail: NTIS HC $3.50 CSCL 17G

Methods of decoding a digital word to display alpha-numeric characters for driving a standard seven-segment LED display have been devised for Omega station identification. The circuit could replace the system now being used in Ohio University's Omega receivers, which lights one of eight LED's to signify the Omega time slot being received. The letters A through H, representing the Omega stations, can be read directly from the seven-segment display. Author

N76-30191*# Ohio Univ., Athens. Dept. of Electrical Engineering.
LOW-COST MECHANICAL FILTERS FOR OMEGA RECEIVERS
R. W. Burhans Jun. 1976 9 p refs
(Grant NGR-36-009-017)
(NASA-CR-148767; TM-30) Avail: NTIS HC $3.50 CSCL 17G

A pair of prototype low frequency mechanical filters were obtained for use as the RF front-end components of an OMEGA-VLF navigation receiver. The filter units are of interest because of very narrow bandwidths and high skirt selectivity to minimize noise and off-channel carriers in the reception of OMEGA signals. In addition, the filters have a characteristic low impedance

of 75 to 5,000 ohms which results in less critical PC board circuitry compared to some previous resonators with termination resistances of 25,000 ohms to 5 megohms. Author

N76-30192*# Ohio Univ., Athens. Dept. of Electrical Engineering.
A MEMORY-MAPPED OUTPUT INTERFACE: OMEGA NAVIGATION OUTPUT DATA FROM THE JOLT (TM) MICROCOMPUTER
Robert W. Lilley Aug. 1976 3 p refs
(Grant NGR-36-009-017)
(NASA-CR-148766; TM-31) Avail: NTIS HC $3.50 CSCL 17G

A hardware interface which allows both digital and analog data output from the JOLT microcomputer is described in the context of a software-based Omega Navigation receiver. The interface hardware described is designed for output of six (or eight with simple extensions) bits of binary output in response to a memory store command from the microcomputer. The interface was produced in breadboard form and is operational as an evaluation aid for the software Ornega receiver. Author

N76-30193*# Ohio Univ., Athens. Dept. of Electrical Engineering.
A MICROPROCESSOR INTERFACE FOR THE OHIO UNIVERSITY PROTOTYPE OMEGA NAVIGATION RECEIVER
Robert W. Lilley Aug. 1976 6 p ref
(Grant NGR-36-009-017)
(NASA-CR-148769; TM-32) Avail: NTIS HC $3.50 CSCL 17G

The Ohio University Omega Prototype Receiver is currently under final design and construction. As initially designed, digital and analog hardware outputs were provided for attachment of tape recorders or chart recording equipment for capture of Omega LOP data. The interface described was designed to demonstrate the concept of direct microprocessor attachment to the existing receiver to allow far more flexibility of output data handling than previously provided. Author

N76-30194*# Ohio Univ., Athens. Avionics Engineering Center.
A MICROCOMPUTER-BASED LOW-COST OMEGA NAVIGATION SYSTEM
Robert W. Lilley and Richard J. Salter, Jr. Aug. 1976 9 p refs Presented at 1st Ann. Meeting, Intern. Omega Assoc., Arlington, Va., 27-29 Jul. 1976
(Grant NGR-36-009-017)
(NASA-CR-148771; TM-34) Avail: NTIS HC $3.50 CSCL 17G

The application of a low cost, commercially available microcomputer as the navigation processor for a simplified OMEGA navigation system is an area of current research. The interface of a low cost front end OMEGA sensor is described and an example of the phase processing software and navigation routines is given. Emphasis is placed on the description of results obtained with the software version of the OMEGA burst filter known as the memory aided phase locked loop. Author

N76-30195*# Ohio Univ., Athens. Avionics Engineering Center.
MINI-O, SIMPLE OMEGA RECEIVER HARDWARE FOR USER EDUCATION
R. W. Burhans Aug. 1976 11 p refs Presented at 1st Ann. Meeting, Intern. Omega Assoc., Arlington, Va., 27-29 Jul. 1976
(Grant NGR-36-009-017)
(NASA-CR-148772; TM-35) Avail: NTIS HC $3.50 CSCL 17G

A problem with the Omega system is a lack of suitable low cost hardware for the small user community. A collection of do it yourself circuit modules are under development intended for use by educational institutions, small boat owners, aviation enthusiasts, and others who have some skills in fabricating their own electronic equipment. Applications of the hardware to time frequency standards measurements, signal propagation monitoring, and navigation experiments are presented. A family of Mini-O systems have been constructed varying from the simplest RF preamplifiers and narrowband filters front-ends, to sophisticated microcomputer interface adapters. Author

N76-30196*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE KEYSTROKING ABILITY OF COMMERCIAL PILOTS
Douglas H. Williams Jul. 1976 9 p refs
(NASA-TM-X-73160; A-6713) Avail: NTIS HC $3.50 CSCL 05E

A sample of airline and commercial pilots was tested on a standard computer keyboard (QWERTY). They were found to have a useful level of proficiency in operation of this keyboard. Implications for the design of alphabetic keyboards for airborne use are discussed. Author

N76-30197# Pacific Missile Test Center, Point Mugu, Calif.
TWO STUDIES OF PREDICTOR DISPLAYS FOR JET AIRCRAFT LANDINGS. 1. OPTIMIZATION OF CONTROL STICK DYNAMICS AND PREDICTION SPAN PARAMETERS. 2. A COMPARISON BETWEEN EXPERIENCED AND NOVICE NAVY F-4 PILOT SIMULATED LANDING PERFORMANCES
Robert S. Kennedy, Russell L. Smith, Joseph W. Wulfeck, John E. Queen, and William J. Burger 15 Oct. 1975 29 p refs
(AD-A021925; PMTC-TP-75-55) Avail: NTIS CSCL 01/2

Two further studies are reported concerning the utility of a predictor display instrument in landing jet aircraft. In the first study, the length of prediction span and control stick dynamics were systematically varied and compared to baseline (no prediction and no stick/control response-delay) condition. Performances on all predictor display conditions were superior to the baseline and the best performance was seen on the experimental condition with the longest prediction span and the longest stick/control response-delay. In the second study, a 6-degree of freedom F-4 night carrier landing simulation flown by pilots who were (N = 6) or were not (N = 6) experienced in that type aircraft. Predictor display performances exceeded baseline conditions for both groups; and as expected, the results showed better performances on the baseline for the experienced F-4 pilots. However, predictor display performances were equivalent for both groups. The letter finding suggests strongly that predictor displays also hold promise as training aids. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N76-30198*# McDonnell Aircraft Co., St. Louis, Mo.
STUDY OF A FAIL-SAFE ABORT SYSTEM FOR AN ACTIVELY COOLED HYPERSONIC AIRCRAFT. VOLUME 1: TECHNICAL SUMMARY Final Report
C. J. Pirello and R. L. Herring Washington NASA Aug. 1976 84 p refs
(Contract NAS1-13631)
(NASA-CR-2652; MDC-A3313-Vol-1) Avail: NTIS HC $5.00 CSCL 01C

Conceptual designs of a fail-safe abort system for hydrogen fueled actively cooled high speed aircraft are examined. The fail-safe concept depends on basically three factors: (1) a reliable method of detecting a failure or malfunction in the active cooling system, (2) the optimization of abort trajectories which minimize the descent heat load to the aircraft, and (3) fail-safe thermostructural concepts to minimize both the weight and the maximum temperature the structure will reach during descent. These factors are examined and promising approaches are evaluated based on weight, reliability, ease of manufacture and cost. Author

N76-30199*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPLICATION OF A HELICOPTER MATHEMATICAL MODEL TO THE LANGLEY DIFFERENTIAL MANEUVERING SIMULATOR FOR USE IN A HELICOPTER/FIGHTER EVASIVE

MANEUVER STUDY

Jacob A. Houck, Billy R. Ashworth, and Dewey R. Baker (Sperry Support Services, Sperry Rand Corp.) Aug. 1976 18 p refs (NASA-TM-X-73935) Avail: NTIS HC $3.50 CSCL 01C

A real time simulation study was conducted using a differential maneuvering simulator to determine and evaluate helicopter evasive maneuvers when attacked by fighter aircraft. A general helicopter mathematical model was modified to represent an H-53 helicopter. The helicopter model was compared to H-53 flight test data to determine any differences between the simulated and actual vehicles. The simulated helicopter was also subjectively validated by participating pilots. Two fighter mathematical models validated in previous studies were utilized for the attacking aircraft. The results of this simulation study have been verified in a flight test program conducted by the U. S. Air Force and were found to closely match the flight results. Author

N76-30200*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

PROGRESS TOWARD DEVELOPMENT OF CIVIL AIR WORTHINESS CRITERIA FOR POWERED-LIFT AIRCRAFT Final Report

Barry C. Scott, Paul W. Martin (FAA, Los Angeles), Charles S. Hynes, and Ralph B. Bryder (Civil Aviation Authority, Airworthiness Div., U.K.) May 1976 74 p refs Sponsored in part by DOT (NASA-TM-X-73124; FAA-RD-76-100) Avail: NTIS HC $4.50 CSCL 01C

The results of a joint research program directed toward development of civil airworthiness flight criteria for power lift transports are summarized. Tentative criteria are proposed for performance and handling characteristics for powered lift transport aircraft in commercial service. The aircraft considered are primarily wing supported vehicles which rely upon the propulsion system for a significant portion of lift and control. VTOL aircraft are excluded. The flight criteria treat primarily the approach and landing flight phases. Author

N76-30201*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

INVESTIGATION OF UPPER-SURFACE-BLOWING NACELLE INTEGRATION AT CRUISE SPEEDS UTILIZING POWERED ENGINE SIMULATORS

E. T. Meleason and O. D. Wells (McDonnell-Douglas Corp., Long Beach, Calif.) 1976 23 p refs Presented at the 12th Propulsion Conf., Palo Alto, Calif., 26-29 Jul. 1976; sponsored by AIAA and SAE

(NASA-TM-X-73447; E-8806) Avail: NTIS HC $3.50 CSCL 01C

Various overwing nacelle designs were investigated on a representative four engine short haul aircraft configuration during a combined analytical and experimental program. Design conditions were M sub o = 0.7 and C sub L = 0.4. All nacelles had D shaped nozzle exits and included a streamline contoured design, a low boattail angle reference configuration, and a high boattail angle powered lift design. Testing was done with the design four engine airplane configuration as well as with only inboard nacelles installed. Turbopowered engine simulators were used to provide realistic representation of nacelle flows. Performance trends are compared for the various nacelle designs. In addition, comparisons are presented between analytical and experimental pressure distributions and between flow through and powered simulator results. Author

N76-30202*# Virginia Univ., Charlottesville. Dept. of Electrical Engineering.

REAL TIME FLIGHT SIMULATION METHODOLOGY Semiannual Report

E. A. Parrish, G. Cook, and E. S. McVey Aug. 1976 65 p refs

(Grant NsG-1151)

(NASA-CR-148728; UVA/528085-EE76/103) Avail: NTIS HC $4.50 CSCL 01A

An example sensitivity study is presented to demonstrate how a digital autopilot designer could make a decision on minimum sampling rate for computer specification. It consists of comparing the simulated step response of an existing analog autopilot and its associated aircraft dynamics to the digital version operating at various sampling frequencies and specifying a sampling frequency that results in an acceptable change in relative stability. In general, the zero order hold introduces phase lag which will increase overshoot and settling time. It should be noted that this solution is for substituting a digital autopilot for a continuous autopilot. A complete redesign could result in results which more closely resemble the continuous results or which conform better to original design goals. Author

N76-30203# European Space Agency, Paris (France).

AERODYNAMIC RESEARCH ON THE SUITABILITY OF A HELICOPTER FOR SIMULATING V/STOL AIRCRAFT

Martin Marchand et al Feb. 1976 58 p refs Transl. into ENGLISH of "Flugmechanische Untersuch. ueber die Einsetzbarkeit eines Hubschraubers zur Simulation von V/STOL-Flugzeugen", DFVLR, Brunswick Report DLR-FB-75-59, 27 Aug. 1975 Original German report available from DFVLR, Cologne DM 22.80

(ESA-TT-256; DLR-FB-75-59) Avail: NTIS HC $4.50

The possibility of using a BO 105 type helicopter as an experimental aircraft with variable flight characteristics for simulating V/STOL aircraft was investigated. The control deflections required for the simulation of given natural motions and acceleration maneuvers are indicated and the maximum simulation amplitudes estimated. Since, by means of the four control deflections of the helicopter, only four of the six degrees of freedom of an aircraft can be simulated simultaneously, the behavior and stability of the helicopter were also investigated in the two degrees of freedom not simulated. Author (ESA)

N76-30204# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.

INVESTIGATION OF A DOUBLE SLOTTED RUDDER FOR APPLICATION ON ADVANCED TACTICAL TRANSPORT AIRCRAFT Final Report, 1 Jun. 1972 - 1 Jan. 1975

Russell F. Osborn, Jr. Dec. 1975 56 p refs

(AF Proj. 1476)

(AD-A022481; AFFDL-TR-75-94) Avail: NTIS CSCL 01/3

The aerodynamic and mechanical design of a double slotted rudder (DSR) system for possible use on the next generation STOL transport aircraft has been synthesized and the aerodynamic configuration tested in the Wichita State University low speed wind tunnel. Data collected during the Phase I wind tunnel program shows the double slotted rudder in combination with a typical transport aircraft vertical tail produces sixty percent greater side force than a comparable double hinged rudder design. Adjustment in slotted rudder geometry directed toward actuation mechanism simplification was made and tested in the second phase of the program. The changes investigated had minimal impact on slotted rudder aerodynamic performance. Further design analysis of the mechanically simplified DSR configuration and wind tunnel testing of a completely operable double slotted rudder are recommended before making a final assessment of the concept. Author (GRA)

N76-30205# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.

VIBRATION AND TEMPERATURE SURVEY PRODUCTION CH-47C HELICOPTER Final Report, 18 Jul. - 20 Sep. 1974

Sep. 1975 218 p refs

(AD-A022348; USAAEFA-70-15-6) Avail: NTIS CSCL 01/3

Vibration and temperature measurement tests were conducted on a production model CH-47C helicopter to define the vibration and temperature environment for the instruments, avionics, pilot station, and selected component parts for representative flight conditions. Testing was performed by the United States Army Aviation Engineering Flight Activity at Edwards Air Force Base, California, between 18 July 1974 and 20 September 1974. The testing consisted of 16 flights totaling 19.3 productive test hours. Vibration data were recorded from 63 accelerometer locations for 55 flight conditions and narrow band spectral analyses were performed on the vibration data. The results of the spectral analyses were summarized by use of statistical methods. GRA

N76-30206# Army Air Mobility Research and Development Lab., Fort Eustis, Va.

MODEL 540 MAIN ROTOR BLADE FATIGUE TEST

Arthur J. Gustafson and Nicholas J. Calapodas Jan. 1976 42 p

(DA Proj. 1F2-63211-DB-41)
(AD-A021472; USAAMRDL-TN-22) Avail: NTIS CSCL 01/3

The occurrence of catastrophic helicopter accidents due to Bell Model 540-11-250-1 main rotor blade structural failure triggered an Army-wide inspection to determine the condition of the existing 540 blade, and full-scale testing to verify the 1100-hour fatigue life of the Model 540 main rotor blade was conducted at the Eustis Directorate. Three Model 540 blades, each having varying bond/debond conditions and numbers of accumulated flight hours, were fatigue tested. Existing inspection techniques for bond/debond detection were used and evaluated, with emphasis placed on nondestructive test techniques. GRA

N76-30207# Advisory Group for Aerospace Research and Development, Paris (France).
HELICOPTER DESIGN MISSION LOAD SPECTRA
Aug. 1976 71 p refs In ENGLISH; partly in FRENCH Presented at 42d Meeting of the Structures and Mater. Panel, Ottawa, Canada, 8 Apr., 1976
(AGARD-CP-206) Avail: NTIS HC $4.50

Mission related load spectra are applied to component fatigue life predictions for helicopter design criteria. For individual titles, see N76-30208 through N76-30213.

N76-30208 Advisory Group for Aerospace Research and Development, Paris (France).
MISSION SPECTRA FOR THE COMPUTATION OF LIFE EXPECTANCIES [SPECTRES DE MISSION POUR LE CALCUL DES DUREES DE VIE]
F. Liard *In its* Helicopter Design Mission Load Spectra Aug. 1976 10 p In FRENCH (For availability see N76-30207 21-05)

The computation of the life expectancies for helicopter parts was shown to be strongly affected by the assumptions made in the type of missions to be performed. It appears preferable to restrict oneself to the most important flight characteristics, such as speed and load factor, instead of including more elaborate data (such as constraints) which cannot be carried over to the design of new helicopters. The choice of helicopters selected should be based on a statistical sampling of the air fleet considered to give reliable information on the average mission spectra of these helicopters, rather than to focus the attention on the single helicopter with the most severe utilization; the reason for this is that it is extremely unlikely that the weakest part would be found on the most highly stressed machine. Transl. by Y.J.A.

N76-30209 Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
THE IMPACT OF HELICOPTER MISSION SPECTRA ON FATIGUE
G. Reichert *In* AGARD Helicopter Design Mission Load Spectra Aug. 1976 17 p refs (For availability see N76-30207 21-05)

Helicopter components are requested to have long service lives, coming close to unlimited lifetimes. However, there are still real problems in the accurate prediction of the resulting component lives because this requires the availability of adequate mission load spectra. The nature of the typical fatigue loading situation, in combination with the requested long lifetimes raises the question of the sensitivity to variations in mission requirements and load spectra. For a light helicopter with a hingeless rotor system using fiberglass rotor blades - in commercial as well as in military application - the influence of different mission requirements on load spectra and fatigue is discussed. Normally, only a small portion of the complete mission is of importance for fatigue. Therefore, the impact of modified mission spectra on fatigue is assessed. Author

N76-30210 Westland Helicopters Ltd., Yeovil (England).
HELICOPTER DESIGN MISSION LOAD SPECTRA
A. D. Hall *In* AGARD Helicopter Design Mission Load Spectra Aug. 1976 5 p (For availability see N76-30207 21-05)

The various stages of helicopter design are related to projected flight mission fatigue load magnitudes and occurrences. The latter were expressed as a percentage of total flying time or as a number of occurrences per hour of flight. Magnitude of loading was derived for the design stage from calculation or by parametric readout from similar aircraft types. The assumed maneuver spectrum was the critical link in developing the design stage, throughout prototype development and model fatigue testing. G.G.

N76-30211 Technology, Inc., Dayton, Ohio.
US AIR FORCE HELICOPTER OPERATIONAL FLIGHT SPECTRA SURVEY PROGRAM: PAST AND PRESENT
G. L. Martin and R. B. Johnson, Jr. *In* AGARD Helicopter Design Mission Load Spectrum Aug. 1976 16 p refs (For availability see N76-30207 21-05)

Development and application of the Flight Condition Recognition (FCR) technique for the processing of helicopter operational data are elaborated. The FCR technique identifies aircraft operations and transitions which are called flight conditions, and flight phases which are called mission segments. Each identification is based on the characteristic behavior of the in-flight parameters. With such identifications, the data processing consists basically of determining the occurrences and durations of the flight conditions and mission segments, of measuring the in-flight parameters, and accordingly of presenting these data so that the flight condition and mission segment time and frequency distributions are quantitatively defined by selected ranges of the flight parameters. This application of the FCR technique permits the fatigue analyst to comprehend and apply more effectively the operational usage spectrum to the calculation of the fatigue life of critical helicopter components. Author

N76-30212 Naval Air Systems Command, Washington, D.C.
US NAVY HELICOPTER OPERATIONAL FLIGHT SPECTRUM SURVEY PROGRAM: PAST AND PRESENT
R. E. Malatino *In* AGARD Helicopter Design Mission Load Spectrum Aug. 1976 13 p refs (For availability see N76-30207 21-05)

In-flight load spectra surveys have been performed on the SH-3A, CH-53A, CH-46D, UH-1E, TH-1L and HH-2D helicopters. Data from these surveys have been used to establish a more rational basis for static and fatigue structural design criteria as well as to more realistically establish the service lives of existing critically loaded structural components. In addition to these in-flight load surveys, data have been obtained during operational landing surveys performed on the HUP-1, HTL-3, HTL-4, HTL-5, HO3S, amd HRS-1 helicopters. These surveys were performed during the early 1950's. In the late 1960's, data were obtained in confined area landing operations with the CH-53A and CH-46F helicopters. Recently, surveys were made during landing operations with the HH-2D and SH-2F aircraft on the landing platforms of small ships at sea. These data have been used to up-date the Navy's design and test criteria for structural strength for landing. Results and details of these surveys as well as the Navy's current plans for future surveys such as flight surveys in mine countermeasures operations with the RH-53D helicopter and at-sea hauldown landing operations with the SH-2F helicopter are discussed. Author

N76-30213 Army Air Mobility Research and Development Lab., Moffett Field, Calif.
CRITIQUE AND SUMMARY OF THE SPECIALISTS MEETING ON HELICOPTER DESIGN MISSION LOAD SPECTRA
Frederick H. Immen *In* AGARD Helicopter Design Mission Load Spectra Aug. 1976 4 p (For availability see N76-30207 21-05)

A low cost structural integrity monitoring system is reported that permits the determination of in-service fatigue damage of helicopter structural components. The parameteric data recording system indicates airspeed, static pressure, outside air temperature, main rotor RPM, roll attitude, vertical acceleration, landing gear touchdown, and engine torque. In addition to measuring mission load spectra in actual service, the use of a highly truncated fatigue load spectrum during initial design is advocated that assumes aircraft operation in the worst loading regime within G load, power, vibration, performance, or stability limits 100% of the time. G.G.

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

N76-30214*# Honeywell, Inc., St. Louis Park, Minn. Government and Aeronautical Products Div.

COMPUTER TECHNOLOGY FORECAST STUDY FOR GENERAL AVIATION

Charles L. Seacord and Darrel Vaughn 30 Jun. 1976 346 p refs

(Contract NAS2-8971)

(NASA-CR-137889) Avail: NTIS HC $10.00 CSCL 01D

A multi-year, multi-faceted program is underway to investigate and develop potential improvements in airframes, engines, and avionics for general aviation aircraft. The objective of this study was to assemble information that will allow the government to assess the trends in computer and computer/operator interface technology that may have application to general aviation in the 1980's and beyond. The current state of the art of computer hardware is assessed, technical developments in computer hardware are predicted, and nonaviation large volume users of computer hardware are identified. S.M.

N76-30215# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

AN EXPERIMENTAL INVESTIGATION OF METHODS OF SUPPRESSING THE UNSTEADY TORQUE EXERTED ON THE UPPER TURNING MIRROR OF AN AIRCRAFT MOUNTED COELOSTAT TURRET M.S. Thesis

R. M. Mullane Jun. 1975 130 p refs

(AD-A021876; GAE/AE/75J-6) Avail: NTIS CSCL 01/3

Various methods of reducing the unsteady torque exerted on the upper turning mirror (UTM) of a coelostat turret were experimentally evaluated. The effect of an aft fairing and the turret aperture on the pressure distribution across the turret was also measured. Areas of flow separation were determined from oil flow patterns. A coelostat model with a turret diameter of five inches and capable of rotating 120 degrees in azimuth was wall mounted in a transonic wind tunnel. Data were collected for Mach numbers of .7, .85, and .95. Passive methods, consisting of external fairings, and active methods, consisting of blowing and suction, were employed to reduce UTM torque. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels;* and *44 Energy Production and Conversion.*

N76-30216*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ACOUSTIC, PERFORMANCE, AND WAKE SURVEY MEASUREMENTS OF A LOBED VELOCITY-DECAYER NOZZLE INSTALLED ON A QUIETED TF-34 TURBOFAN ENGINE

Nick E. Samanich and Laurence J. Heidelberg Washington Aug. 1976 47 p refs

(NASA-TM-X-3413; E-8676) Avail: NTIS HC $4.00 CSCL 21E

Results for three velocity decayer nozzle configurations are compared with those obtained with a separate flow coannular nozzle tested on the same quieted turbofan engine. Peak sideline noise, which occurred 110 degrees from the inlet, was 2 to 4 db louder than with the coannular nozzle at the same ideal effective exhaust velocity and 8 to 11 db louder at the same thrust level. The decayer nozzles produced an increase in loss equivalent to about 4 percent of the engine thrust and also increased the effective exhaust velocity of the engine. The exhaust decayed to 0.35 of its peak velocity, compared with no decay for the coannular nozzle, within 3 equivalent nozzle diameters of the exit. The peak exhaust gas temperature was 400 K lower for the decayer configuration at the same location. The increase in perceived noise level for the decayer nozzles as compared with the coannular nozzle was attributed to the increase in exhaust velocity and the shift in peak spectrum frequency produced by these nozzles. Author

N76-30217*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

VARIABLE-CYCLE ENGINES FOR SUPERSONIC CRUISE AIRCRAFT

Edward Willis 1976 21 p refs Presented at AGARD Propulsion Conf., Paris, 6-9 Sep. 1976

(NASA-TM-X-73463; E-8826) Avail: NTIS HC $3.50 CSCL 21E

Progress and the current status of the Variable Cycle Engine (VCE) study are reviewed with emphasis placed on the impact of technology advancements and design specifications. A large variety of VCE concepts are also examined. B.B.

N76-30218*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

STUDY OF TURBOFAN ENGINES DESIGNED FOR LOW ENERY CONSUMPTION

R. E. Neitzel, R. Hirschkron, and R. P. Johnston Aug. 1976 144 p refs

(Contract NAS3-19201)

(NASA-CR-135053; R76AEG432) Avail: NTIS HC $6.00 CSCL 21E

Subsonic transport turbofan engine design and technology features which have promise of improving aircraft energy consumption are described. Task I addressed the selection and evaluation of features for the CF6 family of engines in current aircraft, and growth models of these aircraft. Task II involved cycle studies and the evaluation of technology features for advanced technology turbofans, consistent with initial service in 1985. Task III pursued the refined analysis of a specific design of an advanced technology turbofan engine selected as the result of Task II studies. In all of the above, the impact upon aircraft economics, as well as energy consumption, was evaluated. Task IV summarized recommendations for technology developments which would be necessary to achieve the improvements in energy consumption identified. Author

N76-30219# AiResearch Mfg. Co., Phoenix, Ariz.

DETERMINATION OF AIRCRAFT TURBINE ENGINE PARTICULATES

Keith M. Johansen and Emerson L. Kumm Washington EPA May 1975 91 p refs

(Contract EPA-68-02-1236)

(PB-251247/3; EPA-650/2-75-055) Avail: NTIS HC $5.00 CSCL 13B

Research conducted to develop measurement techniques for particulate emissions from aircraft gas turbine engines is described. Optimum sampling procedures; parameters, devices, and instruments to use for measuring the mass of particulates emitted from gas turbines operating in the open atmosphere were established. On the basis of a series of tests with a turboprop engine and limited tests with turbofan engines, researchers concluded that: (1) accurate gravimetric measurements of engine particulate emissions can be made, and (2) smoke number (reflectance) measurements do not correlate with gravimetric measurements of engine particulate emissions. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N76-30220 Virginia Polytechnic Inst. and State Univ., Blacksburg.

AEROELASTIC STABILITY BEHAVIOR OF OBLIQUE-

WINGED AIRCRAFT Ph.D. Thesis
John Barrett Crittenden 1976 136 p
Avail: Univ. Microfilms Order No. 76-17095

Aeroelastic instability characteristics of oblique-winged aircraft were determined using the finite element method of analysis. Elastic and inertial properties of all planforms are modeled by using an assemblage of twenty beam elements (ten per semispan) each having plunging, twisting, and bending degrees of freedom. The aerodynamic model consists of twenty trapezoidal strips, arranged parallel to the free-stream flow direction. Unsteady aerodynamic influence coefficients were calculated using a doublet-lattice technique applicable to the subsonic flow regime only. The V-g method of flutter analysis was used to calculate wing divergence and flutter speeds for a variety of parameter combinations. The wing parameter variations included changes in geometry; stiffness and inertial properties; and root, or fuselage, freedom. Flutter and divergence characteristics of the oblique-wing configurations were found to be similar to those of bilaterally symmetric aircraft in most cases. Dissert. Abstr.

N76-30221 Michigan Univ., Ann Arbor.
TERRAIN FOLLOWING CONTROL BASED ON AN OPTIMIZED SPLINE MODEL OF AIRCRAFT MOTION Ph.D. Thesis
James Everett Funk 1976 189 p
Avail: Univ. Microfilms Order No. 76-19139

The computational processing of information in aircraft terrain following systems is discussed. A scheme is presented to incorporate the major portion of the computation into an optimization problem that considers all of the major constraints: (1) a lower bound on the clearance height above the terrain, (2) normal acceleration limits on the aircraft, (3) jerk (time rate of change of acceleration) limits, and (4) flight path slope constraints. Criteria for maintaining the flight path close to the terrain is investigated. A general performance measure is considered with linear, quadratic, and min max options.
Dissert. Abstr.

N76-30222*# Stanford Univ., Calif. Guidance and Control Lab.
AIRCRAFT DIGITAL CONTROL DESIGN METHODS Final Report
J. David Powell, Eric Parsons, and Michael G. Tashker Feb. 1976 80 p refs
(Grant NsG-1137)
(NASA-CR-148604; SU-DAAR-500) Avail: NTIS HC $5.00 CSCL 01C

Variations in design methods for aircraft digital flight control are evaluated and compared. The methods fall into two categories; those where the design is done in the continuous domain (or s plane) and those where the design is done in the discrete domain (or z plane). Design method fidelity is evaluated by examining closed loop root movement and the frequency response of the discretely controlled continuous aircraft. It was found that all methods provided acceptable performance for sample rates greater than 10 cps except the uncompensated s plane design method which was acceptable above 20 cps. A design procedure based on optimal control methods was proposed that provided the best fidelity at very slow sample rates and required no design iterations for changing sample rates. Author

N76-30223*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ANALYTICAL DISPLAY DESIGN FOR FLIGHT TASKS CONDUCTED UNDER INSTRUMENT METEOROLOGICAL CONDITIONS
Ronald A. Hess (Naval Postgraduate School) Aug. 1976 51 p refs
(NASA-TM-X-73146; A-6636) Avail: NTIS HC $4.50 CSCL 01C

Paramount to proper utilization of electronic displays is a method for determining pilot-centered display requirements. Display design should be viewed fundamentally as a guidance and control problem which has interactions with the designer's knowledge of human psychomotor activity. From this standpoint, reliable analytical models of human pilots as information processors and controllers can provide valuable insight into the display design process. A relatively straightforward, nearly algorithmic procedure for deriving model-based, pilot-centered display requirements was developed and is presented. The optimal or control theoretic pilot model serves as the backbone of the design methodology, which is specifically directed toward the synthesis of head-down, electronic, cockpit display formats. Some novel applications of the optimal pilot model are discussed. An analytical design example is offered which defines a format for the electronic display to be used in a UH-1H helicopter in a landing approach task involving longitudinal and lateral degrees of freedom. Author

N76-30224*# Virginia Military Inst., Lexington.
DIGITAL ADAPTIVE CONTROL OF A VTOL AIRCRAFT Final Report, Nov. 1973 - Aug. 1976
Gerald F. Reid Aug. 1976 59 p refs
(Grant NGR-47-018-005)
(NASA-CR-148778) Avail: NTIS HC $4.50 CSCL 01C

A technique has been developed for calculating feedback and feedforward gain matrices that stabilize a VTOL aircraft while enabling it to track input commands of forward and vertical velocity. Leverrier's algorithm is used in a procedure for determining a set of state variable, feedback gains that force the closed loop poles and zeroes of one pilot input transfer function to be at preselected positions in the s plane. This set of feedback gains is then used to calculate the feedback and feedforward gains for the velocity command controller. The method is computationally attractive since the gains are determined by solving systems of linear, simultaneous equations. Responses obtained using a digital simulation of the longitudinal dynamics of the CH-47 helicopter are presented. Author

N76-30225# Lockheed-California Co., Burbank.
ACTIVE SHIMMY CONTROL SYSTEM Final Report, Oct. 1974 - Dec. 1975
Max Gamon and Tom Mahone Wright-Patterson AFB, Ohio AFFDL Dec. 1975 172 p
(Contract F33615-75-C-3005; AF Proj. 1369)
(AD-A022146; AFFDL-TR-75-136) Avail: NTIS CSCL 01/2

A T-37 nose gear is modeled as a multiple lumped mass system with four torsional-degrees-of-freedom and one lateral-degree-of-freedom. Fuselage flexibility is incorporated, and a Von Schlippe tire model is used. The equations of motion for various input conditions are solved using measured gear properties. An Active Shimmy Control System is incorporated in the analytical model. A feedback signal proportional to angular velocity is used to control the hydraulic actuator pressure. The equations of motion for the gear with active control are solved for the same inputs as for the passive gear, and their responses are compared. System parameter values were varied about the nominal measured values to determine their effects for both active and passive systems. A breadboard Active Shimmy Control System was built based on the model results. A test program was performed establishing regions of shimmy for the passive gear. The same conditions were repeated with the active system. Substantial improvement was seen. A comparison with the theoretical predictions showed good correlation. Author (GRA)

N76-30226# City Univ., London (England).
AN INTRODUCTION TO HELICOPTER AIR RESONANCE
A. R. S. Bramwell Aeron. Res. Council 1975 31 p refs Supersedes ARC-33886 Sponsored in part by Min. of Defence
(ARC-R/M-3777; ARC-33886) Avail: NTIS HC $4.00; HMSO £2.20; PHI

The phenomenon known as air resonance, peculiar to helicopters with hingeless rotors, is analyzed and presented. In the air resonance case the body mode with frequency close to the whirling frequency of the rotor C.G. is much more heavily damped than in ground resonance, and the damping of the modes of motion is apparently unaffected by coincidence of the body and whirl frequencies. The slower of the two C.G. whirl modes is unstable if only the aerodynamic lag damping is present and it appears that at least 4 percent of critical damping is required for all the modes to be stable. A resonant situation may occur if the lag stiffness is so high that the blade lag frequency coincides with the flapping frequency. With low damping large lag amplitudes may be excited by Coriolis forces when blade flapping occurs. Author (ESA)

N76-30227# European Space Agency, Paris (France).
MAXIMUM LIKELIHOOD IDENTIFICATION USING KALMAN FILTERING. LEAST SQUARES ESTIMATION. A COMPARISON FOR THE ESTIMATION OF STABILITY DERIVATIVES CONSIDERING GUST DISTURBANCES
Gerd Schulz Feb. 1976 54 p refs Transl. into ENGLISH of 'Maximum-Likelihood-Identifizierung mittels Kalman-Filterung. Kleinste-Quadrate-Schaetzung. Ein Vergleich bei der Bestimmung von Stabilitaetsderivativa unter Berueckschichtigung von Boeenstoerungen', DFVLR, Oberpfaffenhofen, West Ger. Report DLR-FB-75-54, 12 Aug. 1975 Original German report available from DFVLR, Cologne DM 21.80
(ESA-TT-258; DLR-FB-75-54) Avail: NTIS HC $4.50

Starting from the force and moment equations of the longitudinal motion of an aircraft, a state space model was derived which allows bias, gust disturbances, and nonlinear effects to be taken into account. A description of the maximum likelihood identification procedure, including the corresponding linear state estimation according to Kalman, is given. A least squares estimation procedure is also presented. A comparison of the above estimation methods when used for identification of the stability derivatives of the longitudinal motion of an aircraft shows the maximum likelihood procedure to be superior. It is also shown that the identification of the nondimensional derivatives improves the speed of convergence. Author (ESA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N76-30228*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL INVESTIGATION TO VALIDATE USE OF CRYOGENIC TEMPERATURES TO ACHIEVE HIGH REYNOLDS NUMBERS IN BOATTAIL PRESSURE TESTING
David E. Reubush Washington Aug. 1976 35 p refs
(NASA-TM-X-3396; L-10827) Avail: NTIS HC $4.00 CSCL 14B

An investigation has been conducted in the Langley 1/3 meter transonic cryogenic tunnel to validate the use of cryogenic temperatures to achieve high Reynolds numbers in nozzle boattail pressure testing. Tests were conducted at 0 degree angle of attack and at Mach numbers of 0.60, 0.85, and 0.90 on two wing-body configurations with differing boattail geometries. Test data were obtained by using two different techniques, the cryogenic method and the conventional method, to obtain the same Reynolds number. Later, the test data obtained from the two techniques on boattail pressure coefficient distributions and pressure drag coefficients were compared; results from the comparisons show excellent repeatability for all test conditions and indicate no measurable errors when using cryogenic temperatures to achieve high Reynolds numbers for nozzle boattail pressure testing. Author

N76-30229*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MEASURED OPENING CHARACTERISTICS OF AN ELECTROMAGNETICALLY OPENED DIAPHRAGM FOR THE LANGLEY EXPANSION TUNNEL
John A. Moore Washington Aug. 1976 32 p refs
(NASA-TM-X-3378; L-10796) Avail: NTIS HC $4.00 CSCL 14B

Results from an experimental study of the opening characteristics of an electromagnetically opened, 15.24 cm diameter diaphragm are presented. This diaphragm consists of a polyester film bonded to a preformed wire and is opened by passing a current pulse (capacitor discharge) through the wire. The diaphragm separates the acceleration section of the expansion tunnel from the nozzle so that the nozzle may be at a lower pressure than the acceleration section prior to a test. Opening times and cleanness of the opened area were examined for dependence on diaphragm thickness, on wire diameter, on technique of bonding the wire to the diaphragm, and on voltage and energy level of the energy source. Time histories of the pitot pressure measured at the expansion-tunnel nozzle entrance location are presented for (1) no diaphragm, (2) a flow-opened diaphragm, and (3) an electromagnetically opened diaphragm. Author

N76-30230*# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
HARDWALL ACOUSTICAL CHARACTERISTICS AND MEASUREMENT CAPABILITIES OF THE NASA LEWIS 9 X 15 FOOT LOW SPEED WIND TUNNEL
Peter E. Rentz Jun. 1976 96 p refs
(Contract NAS3-19410)
(NASA-CR-135025; BBN-3174) Avail: NTIS HC $5.00 CSCL 14B

Experimental evaluations of the acoustical characteristics and source sound power and directionality measurement capabilities of the NASA Lewis 9 x 15 foot low speed wind tunnel in the untreated or hardwall configuration were performed. The results indicate that source sound power estimates can be made using only settling chamber sound pressure measurements. The accuracy of these estimates, expressed as one standard deviation, can be improved from + or - 4 db to + or - 1 db if sound pressure measurements in the preparation room and diffuser are also used and source directivity information is utilized. A simple procedure is presented. Acceptably accurate measurements of source direct field acoustic radiation were found to be limited by the test section reverberant characteristics to 3.0 feet for omni-directional and highly directional sources. Wind-on noise measurements in the test section, settling chamber and preparation room were found to depend on the sixth power of tunnel velocity. The levels were compared with various analytic models. Results are presented and discussed. Author

N76-30231# Martin Marietta Aerospace, Orlando, Fla.
BOMB DAMAGE REPAIR (BDR) DAMAGE PREDICTION. VOLUME 2. APPENDICES Final Report, 14 Feb. - 15 Oct. 1975
George W. Brooks, John E. Cunningham, and Paul W. Mayer Oct. 1975 412 p
(Contract F29601-75-C-0053; AF Proj. 2104)
(AD-A021315; AFCEC-TR-75-24-Vol-2-App) Avail: NTIS CSCL 01/5

Knowledge of airfield damage and the capability to predict damage from possible hostile attack are required to allow Bomb Damage Repair (BDR) personnel to plan base recovery activity and rapid runway repair. The objective of this effort was to collect existing data on airfield pavement effects, as functions of pavement and weapon parameters, identify those parameters having a significant effect on pavement damage and repair time effort, and to generate damage prediction relationships for use by BDR engineers. The collected data were placed in a consistent format in a computerized data file. By plotting the data and subjecting them to various analytical procedures, significant parameters affecting damage were identified. Mathematical relationships were developed between the data, and damage prediction monographs were generated for the three repair levels considered. These prediction relationships are in a format readily usable by field personnel and enable rapid damage prediction computations and subsequent runway repair planning operations. GRA

N76-30232# New Mexico Univ., Albuquerque. Eric H. Wang Civil Engineering Research Facility.
EVALUATION OF LIQUID BINDERS FOR AIRFIELD BOMB DAMAGE REPAIR Final Report, 24 Apr. 1974 - 30 Jun. 1975
John P. Nielsen and Vincent Cassino 30 Jun. 1975 41 p
(Contract F29601-74-C-0030)
(AD-A021353; CERF-AP-14; AFCEC-TR-75-25) Avail: NTIS CSCL 01/5

A laboratory and a field study were conducted to evaluate the use of an epoxy binder to stabilize a gravel layer for the repair of bomb craters in airfield pavements. The particular repair system investigated consisted of backfilling the crater with

ejected debris, sand to within 12 in of the top of the pavement, and a 3/4-in uniform gravel to the surface. The gravel was stabilized by a liquid epoxy resin which had a cure time of 10 to 15 min. The field test section successfully withstood 100 passes of an F-4 tire loaded to 30,500 lb without any measurable elastic or permanent deflection. GRA

N76-30233# Syracuse Univ. Research Corp., N.Y.
RAPID RUNWAY REPAIR STUDY Final Report, May - Aug. 1975
Leo L. Boyko and Richard G. Sawyer Aug. 1975 51 p
(Contract F08638-75-C-0010)
(AD-A021352; SURC-TR-75-197; AFCEC-TR-75-19) Avail: NTIS CSCL 01/5

This report describes a series of tests to evaluate a system for rapidly repairing airfield pavement using polymer concrete (synthetic polymer plus aggregate), thermally cured by microwave power. The technique, developed by the Syracuse University Research Corporation (SURC) for highway maintenance, uses a truck-mounted 50-kilowatt microwave generator to irradiate areas patched with polymer concrete. Test results indicate that the polymer concrete can be cured in a fraction of an hour, bonds well to old pavement material, is very strong, and possesses other qualities which make it naturally suited for airfield use. GRA

N76-30234# National Bureau of Standards, Washington, D.C.
SPECIAL TECHNICAL FACILITIES AT THE NATIONAL BUREAU OF STANDARDS, 1976 EDITION
H. L. Mason and Iris M. Lloyd Mar. 1976 58 p refs
(PB-251841/3; NBS-SP-413) Avail: NTIS HC $4.50 CSCL 14B

Among the major technical facilities of the NBS laboratories in Gaithersburg, Md., and Boulder, Colo., are some which are unique and many which feature equipment that is relatively uncommon. These important resources deserve to be more widely known and used by the scientific and engineering community, including the Bureau's own staff, other Government agencies, industrial research associates, academic researchers, and postdoctoral fellows. Those facilities which are available for shared use, either occasional or extended, are briefly described. GRA

N76-30235# Computer Sciences Corp., Falls Church, Va.
AIRPORT SURFACE TRAFFIC CONTROL CONCEPT FORMULATIONS STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report, Sep. 1973 - Feb. 1975
F. DAlessandro, W. Heiser, G. Knights, P. Monteleon, and R. Reffelt Jul. 1975 79 p refs
(Contract DOT-TSC-678)
(AD-A022026; FAA-RD-75-1201; FAA-75-8.1) Avail: NTIS CSCL 17/5

This four-volume report presents system concepts for use in semi-automated airport surface traffic control at all positions in the tower cab of the major airports. The control functions and data requirements of a Ramp Control System, a ground Control System, and a Local Control System are presented. The concept development process has been based upon an extensive study of cab operations at O'Hare Airport. This effort has included extensive delay analysis, study of communication tapes, and personal observations of the widely-varying situations that are faced by tower controllers. Following the Operations Analysis effort, a detailed study of requirements was performed and is presented in Volume IV of this report. This requirements effort provided an estimate of the performance requirements of a surveillance sensor that would be required in a TAGS (Tower Automated Ground Surveillance) system for use in both good and poor visibility conditions. Detailed studies were made of the complex type of conflicts to be solved by both the Ground and Local Controllers, and operational levels and densities were developed. One particular TAGS system concept (employing an ATCRBS Trilateration Surveillance Subsystem) is described in Volume I, and an estimate is made of its deployment potential at major airports. Backup material on this concept in the form of a working paper is held by TSC. This working paper also includes synthetic digital display concepts for the three systems which have been summarized in Volume I. Author (GRA)

N76-30236# Advisory Group for Aerospace Research and Development, Paris (France).
TECHNICAL EVALUATION REPORT ON THE FLUID DYNAMICS PANEL SYMPOSIUM ON WIND TUNNEL DESIGN AND TESTING TECHNIQUES
B. H. Goethert Aug. 1976 23 p Held at London, Oct. 1975
(AGARD-AR-97; AGARD-CP-174; ISBN-92-835-1222-7) Avail: NTIS

Advanced wind tunnel systems are discussed with emphasis on the impact of the cryogenic concept for high performance transonic wind tunnels. Topics covered include: cryogenic operation, adjustable walls, magnetic suspensions, and laser instrumentation. Author

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N76-30237 Wisconsin Univ., Madison.
A STUDY OF BRAZING IN SKYLAB 2 Ph.D. Thesis
Thomas Allen Siewert 1976 191 p
Avail: Univ. Microfilms Order No. 76-16019

Comparison of brazed joints processed on earth and aboard Skylab 2 in the summer of 1973 proved that brazing is a viable joining process under the prevailing conditions of atmosphere and near zero gravity in space. Wider gap joints may be brazed in space than in the earth's gravity field, but metallurgical interactions are quite similar. Greater grain boundary attack and a higher percentage of substrate material dissolved or dispersed in the braze alloy with greater gap filling efficiency and more consistent meniscii were observed on Skylab brazed joints. Deformation of some gap joints and anomalous separation of a copper rich phase in one Skylab specimen were also observed. Many ground based experiments were performed to evaluate the role of gravity and low pressure in these results.
Dissert. Abstr.

N76-30238# Committee on Aeronautical and Space Sciences (U. S. Senate).
SOVIET SPACE PROGRAMS, 1971-1975 OVERVIEW, FACILITIES AND HARDWARE, MANNED AND UNMANNED FLIGHT PROGRAMS, BIOASTRONAUTICS, CIVIL AND MILITARY APPLICATIONS, PROJECTIONS OF FUTURE PLANS, VOLUME 1
Washington GPO 1976 687 p refs Rept. for Comm. on Aeron. and Space Sci., 30 Aug. 1976 Prepared by Library of Congr., Sci. Policy Res. Div.
(GPO-67-371) Avail: SOD HC $5.55

Soviet space resources, facilities and hardware, past and on-going programs of flight, research and application, and projections of future plans are reviewed. Launch sites, launch vehicles, tracking and other ground support, the Kosmos program, interplanetary flight and lunar flight, military space activities, and applications of space to the economy and life sciences are among the topics covered. J.M.S.

N76-30239# Committee on Aeronautical and Space Sciences (U. S. Senate).
SOVIET SPACE PROGRAMS, 1971-1975 GOALS AND PURPOSES, ORGANIZATION, RESOURCE ALLOCATIONS, ATTITUDES TOWARD INTERNATIONAL COOPERATION AND SPACE LAW, VOLUME 2
Washington GPO 1976 231 p refs Rept. for Comm. on Aeron. and Space Sci., 30 Aug. 1976 Prepared by Library of Congr.
(GPO-67-596) Avail: SOD HC $2.25

Various aspects of the Soviet space program are outlined. These include: political goals and purposes, organization and administration, resource burden including secrecy and space allocations, Soviet attitude toward international cooperation in space and outer space law are also covered. J.M.S.

N76-30240*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ENCYCLOPEDIA OF SATELLITES AND SOUNDING ROCK-

ETS, AUGUST 1959 - DECEMBER 1969
1970 333 p refs
(NASA-TM-X-74145) Avail: NTIS HC $10.00 CSCL 22A

Major space missions utilizing satellites or sounding rockets managed by the NASA Goddard Space Flight Center between August 1959 and December 1969 were documented. The information was presented in the following form: (1) description of each satellite project where Goddard was responsible for the spacecraft or the successful launch or both, with data such as launch characteristics, objectives, etc.; (2) description of each Goddard sounding rocket project, with the following data: sounding rocket type, vehicle number, experimental affiliation, and type of experiment; (3) brief description of current sounding rockets and launch vehicles; (4) table of tracking and data acquisition stations. Summary tables are also provided. Y.J.A.

N76-30241*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO SOYUZ MISSION, TOXIC GAS ENTERED CABIN DURING EARTH LANDING SEQUENCE
Dec. 1975 31 p refs
(NASA-TM-X-74148; JSC-10638; Anomaly-Rept-1) Avail: NTIS HC $4.00 CSCL 22A

A postflight analysis is presented of the sequence which caused toxic gas to enter the cabin during repressurization for 30 seconds from manual deployment of the drogue parachutes at 18,550 feet to disabling of the reaction control system at 9600 feet. Results and conclusions are discussed. Author

N76-30242*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO SOYUZ, MISSION EVALUATION REPORT
Dec. 1975 254 p refs
(NASA-TM-X-74149; JSC-10607) Avail: NTIS HC $9.00 CSCL 22A

The Apollo Soyuz mission was the first manned space flight to be conducted jointly by two nations - the United States and the Union of Soviet Socialist Republics. The primary purpose of the mission was to test systems for rendezvous and docking of manned spacecraft that would be suitable for use as a standard international system, and to demonstrate crew transfer between spacecraft. The secondary purpose was to conduct a program of scientific and applications experimentation. With minor modifications, the Apollo and Soyuz spacecraft were like those flown on previous missions. However, a new module was built specifically for this mission - the docking module. It served as an airlock for crew transfer and as a structural base for the docking mechanism that interfaced with a similar mechanism on the Soyuz orbital module. The postflight evaluation of the performance of the docking system and docking module, as well as the overall performance of the Apollo spacecraft and experiments is presented. In addition, the mission is evaluated from the viewpoints of the flight crew, ground support operations, and biomedical operations. Descriptions of the docking mechanism, docking module, crew equipment and experiment hardware are given. Author

N76-30243*# Aerospace Corp., El Segundo, Calif. Systems Engineering Operations.
ADVANCED SPACE PROGRAM STUDIES, OVERALL EXECUTIVE SUMMARY
Mar. 1976 48 p
(Contract NASw-2727)
(NASA-CR-148702; ATR-76(7379-01)-1) Avail: NTIS HC $4.00 CSCL 22A

Multidisciplined advanced planning studies were conducted that involve space operations and the associated system elements, identification of potential low cost system techniques, vehicle design, cost synthesis techniques, DoD technology forecasting, and the development of near and far term space initiatives with emphasis on domestic and military use commonality. Specific areas studied include: (1) manned systems utilization; (2) STS users; (3) vehicle cost/performance; (4) space vehicle applications to future national needs; (5) STS spin stabilized upper stage; and (6) technology assessment and forecast. J.M.S.

N76-30244*# Aerospace Corp., El Segundo, Calif. Systems Engineering Operations.
ADVANCED SPACE SYSTEM CONCEPTS AND THEIR ORBITAL SUPPORT NEEDS (1980 - 2000). VOLUME 1: EXECUTIVE SUMMARY
I. Bekey, H. L. Mayer, and M. G. Wolfe Apr. 1976 53 p 4 Vol.
(Contract NASw-2727)
(NASA-CR-148704; ATR-76(7365)-1-Vol-1) Avail: NTIS HC $4.50 CSCL 22A

The likely system concepts which might be representative of NASA and DoD space programs in the 1980-2000 time period were studied along with the programs' likely needs for major space transportation vehicles, orbital support vehicles, and technology developments which could be shared by the military and civilian space establishments in that time period. Such needs could then be used by NASA as an input in determining the nature of its long-range development plan. The approach used was to develop a list of possible space system concepts (initiatives) in parallel with a list of needs based on consideration of the likely environments and goals of the future. The two lists thus obtained represented what could be done, regardless of need; and what should be done, regardless of capability, respectively. A set of development program plans for space application concepts was then assembled, matching needs against capabilities, and the requirements of the space concepts for support vehicles, transportation, and technology were extracted. The process was pursued in parallel for likely military and civilian programs, and the common support needs thus identified. Author

N76-30245*# Aerospace Corp., El Segundo, Calif.
ADVANCED SPACE SYSTEM CONCEPTS AND THEIR ORBITAL SUPPORT NEEDS (1980 - 2000). VOLUME 2: FINAL REPORT
I. Bekey, H. L. Mayer, and M. G. Wolfe Apr. 1976 188 p
(Contract NASw-2727)
(NASA-CR-148703; ATR-76(7365)-1-Vol-2) Avail: NTIS HC $7.50 CSCL 22A

The results are presented of a study which identifies over 100 new and highly capable space systems for the 1980-2000 time period: civilian systems which could bring benefits to large numbers of average citizens in everyday life, much enhance the kinds and levels of public services, increase the economic motivation for industrial investment in space, expand scientific horizons; and, in the military area, systems which could materially alter current concepts of tactical and strategic engagements. The requirements for space transportation, orbital support, and technology for these systems are derived, and those requirements likely to be shared between NASA and the DoD in the time period identified. The high leverage technologies for the time period are identified as very large microwave antennas and optics, high energy power subsystems, high precision and high power lasers, microelectronic circuit complexes and data processors, mosaic solid state sensing devices, and long-life cryogenic refrigerators. Author

N76-30246*# Aerospace Corp., El Segundo, Calif. Systems Engineering Operations.
ADVANCED SPACE SYSTEM CONCEPTS AND THEIR ORBITAL SUPPORT NEEDS (1980 - 2000). VOLUME 3: DETAILED DATA. PART 1: CATALOG OF INITIATIVES, FUNCTIONAL OPTIONS, AND FUTURE ENVIRONMENTS AND GOALS
I. Bekey, H. L. Mayer, and M. G. Wolfe Apr. 1976 146 p 4 Vol.
(Contract NASw-2727)
(NASA-CR-148710; ATR-76(7365)-1-Vol-3-Pt-1) Avail: NTIS HC $6.00 CSCL 22A

The following areas were discussed in relation to a study of the commonality of space vehicle applications to future national needs: (1) index of initiatives (civilian observation, communication, support), brief illustrated description of each initiative, time periods (from 1980 to 2000+) for implementation of these initiatives; (2) data bank of functional system options, presented in the form of data sheets, one for each of the major functions, with the system option for near-term, midterm, and far-term space projects applicable to each subcategory of functions to be fulfilled; (3) table relating initiatives and desired goals (public service and humanistic, materialistic, scientific and intellectual); and (4) data on size, weight and cost estimations. Y.J.A.

N76-30247*# Aerospace Corp., El Segundo, Calif. Advanced Orbital Systems Div.
ADVANCED SPACE SYSTEM CONCEPTS AND THEIR ORBITAL SUPPORT NEEDS (1980 - 2000). VOLUME 4: DETAILED DATA. PART 2: PROGRAM PLANS AND COMMON SUPPORT NEEDS (A STUDY OF THE COMMONALITY OF SPACE VEHICLE APPLICATIONS TO FUTURE NATIONAL NEEDS
I. Bekey, H. L. Mayer, and M. G. Wolfe Apr. 1976 266 p ref
(Contract NASw-2727)
(NASA-CR-148708; ATR-76(7365)-1-Vol-4-Pt-2) Avail: NTIS HC $9.00 CSCL 22A

The methodology of alternate world future scenarios is utilized for selecting a plausible, though not advocated, set of future scenarios each of which results in a program plan appropriate for the respective environment. Each such program plan gives rise to different building block and technology requirements, which are analyzed for common need between the NASA and the DoD for each of the alternate world scenarios. An essentially invariant set of system, building block, and technology development plans is presented at the conclusion, intended to allow protection of most of the options for system concepts regardless of what the actual future world environment turns out to be. Thus, building block and technology needs are derived which support: (1) each specific world scenario; (2) all the world scenarios identified in this study; or (3) generalized scenarios applicable to almost any future environment. The output included in this volume consists of the building blocks, i.e.: transportation vehicles, orbital support vehicles, and orbital support facilities; the technology required to support the program plans; identification of their features which could support the DoD and NASA in common; and a complete discussion of the planning methodology. Author

N76-30248# Committee on Aeronautical and Space Sciences (U. S. Senate).
SPACE PROCESSING
Washington GPO 1976 90 p refs Hearing before Subcomm. on Aerospace Technol. and Natl. Needs of Comm. on Aeron. and Space Sci., 94th Congr., 2d Sess., 17 Jun. 1976
(GPO-75-365) Avail: SOD HC $1.10

The potential benefits of materials processing in space are examined. Experience gained through Apollo flights, Skylab, Apollo Soyuz and the sounding rocket program is cited. Other factors discussed include: economics, erection of large space stations in orbit around the earth, and engineering requirements for the space shuttle and Spacelab. J.M.S.

N76-30249*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIMENT REPORT: LUNAR-SAMPLE PROCESSING IN THE LUNAR RECEIVING LABORATORY HIGH-VACUUM COMPLEX
David R. White Washington Aug. 1976 42 p
(NASA-TN-D-8298; JSC-S-459; JSC-07272) Avail: NTIS HC $4.00 CSCL 14B

A high-vacuum complex composed of an atmospheric decontamination system, sample-processing chambers, storage chambers, and a transfer system was built to process and examine lunar material while maintaining quarantine status. Problems identified, equipment modifications, and procedure changes made for Apollo 11 and 12 sample processing are presented. The sample processing experiences indicate that only a few operating personnel are required to process the sample efficiently, safely, and rapidly in the high-vacuum complex. The high-vacuum complex was designed to handle the many contingencies, both quarantine and scientific, associated with handling an unknown entity such as the lunar sample. Lunar sample handling necessitated a complex system that could not respond rapidly to changing scientific requirements as the characteristics of the lunar sample were better defined. Although the complex successfully handled the processing of Apollo 11 and 12 lunar samples, the scientific requirement for vacuum samples was deleted after the Apollo 12 mission just as the vacuum system was reaching its full potential. Author

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N76-30250*# Texas Univ., Austin. Applied Mechanics Research Lab.
A COMPARISON OF COMPUTATIONAL MODELS FOR THE SATELLITE RELATIVE POSITION PROBLEM
Richard E. McKenzie May 1976 120 p refs
(Contract NAS5-20946)
(NASA-CR-144794; AMRL-1078) Avail: NTIS HC $5.00 CSCL 22A

Formulations of the equations of motion for two bodies orbiting a central body are compared. All equations compared will be valid for both close approaches and large separations. This will allow a more careful study of the regions in which the individual equations are most applicable. Author

N76-30251# European Space Agency, Paris (France).
AERODYNAMIC REENTRY PROBLEMS IN WIND TUNNEL FACILITIES AT LOW DENSITIES AND HIGH ENERGY
Manfred Becker Feb. 1976 57 p refs Transl. into ENGLISH of 'Aerodynamische Wiedereintrittsprobleme in Windkanalanlagen bei sehr geringer Dichte u. grosser Energie', DFVLR, Cologne Report DLR-Mitt-75-16, 9 Sep. 1975 Original German report available from DFVLR, Cologne DM 23.70
(ESA-TT-264; DLR-Mitt-75-16) Avail: NTIS HC $4.50

Spacecraft reentry problems are discussed. Mean free path, viscosity, particle density, deceleration, and aerodynamic heating aspects are dealt with. The reentry process is discussed. The wind tunnel facilities available at Cologne-Porz and the measuring techniques employed there are described. A number of specific investigations and possibilities of further application are discussed. A summary of the investigations concerning this topic performed in the 'Low Density, High Enthalpy Branch' of the Institute is given. Author (ESA)

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N76-30252# Telespazio, S.p.A., Rome (Italy).
THE LANDSAT EARTH RESOURCES GROUND RECEIVING AND PROCESSING STATION AT FUCINO, ITALY
G. Bressanin Nov. 1975 16 p Presented at the Remote Sensing Soc. Meeting, London, 20 Nov. 1975
Avail: NTIS HC $3.50

The Italian ground facility which began operations in April 1975 in Fucino, near Rome, Italy, includes an antenna 10 m in diameter equipped with the relevant control and receiving subsystems, and a data recording and processing subsystem. The main features of the latter two subsystems are described. Technical solutions adopted for these systems differ significantly from those utilized in other existing systems (NASA, CCRS, INPE) in that a totally digital approach is used. The throughput achievable is basically limited by the speed of the input/output devices on which image data is stored for distribution to the users' community. Radiometric and geometric corrections are off-loaded to a high-speed programmable processor, which operates in conjunction with a general purpose minicomputer. This setup is also used for further processing of the data. The products available from the facility include 70 mm black and white transparencies, 240 mm black and white paper prints, and computer compatible tapes. Images and tapes are framed and referenced consistently with the Worldwide Reference System for LANDSAT data retrieval. Author (ESA)

N76-30253# European Space Operations Center, Darmstadt (West Germany).
METEOSAT DATA PROCESSING OUTLINE
K. G. Lenhart 1975 16 p ref Presented at the COSPAR Meeting, Varna, Bulg., 30 May 1975
Avail: NTIS HC $3.50

The ground data handling system which the European Space Agency (ESA) is developing is presented as it will be used to support the European geostationary meteorological satellite Meteosat, to be launched early 1977. The overall system aspect is explained as well as the data processing requirements for image processing and meteorological tasks. The real time environment in which the work has to be performed is defined by the incoming data steams (mainly images) and the products which have to be disseminated to the users via the satellite.
Author (ESA)

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N76-30254 Stanford Univ., Calif.
PARTIALLY DRAG-FREE SATELLITES WITH APPLICATION TO THE TIP 2 SATELLITE Ph.D. Thesis
John Countney Ray, Jr. 1976 241 p
Avail: Univ. Microfilms Order No. 76-18795

Disturbance compensation is accomplished by control of thrustors to prevent an internal proof mass from touching the walls of its cavity. A passive proof mass suspension must be provided in the uncompensated directions of a partially drag-free satellite. General equations are developed for translation and rotation of both a partially drag-free satellite and its proof mass, including coupling forces and moments due to the suspension, gravity gradient, thrustors, attitude control, and disturbances. The performance of a partially drag-free satellite is analyzed using these equations. The significant problems of partially drag-free satellites are found in the design of a proof mass suspension and a controller to ensure its stability. The general equations are specialized for the single-axis in-track case, and the suspension is shown to be sufficiently decoupled for independent analysis. A controllability analysis shows that if the suspension has radial symmetry, proof mass motion is not fully controllable by the suspension in the absence of external forces, and a final state of orbital motion of the proof mass about the suspension centerline is possible. General equations for design of an optimal suspension controller are developed and solved explicitly for the case of no proof mass angular momentum about the suspension centerline. Dissert. Abstr.

N76-30255*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INVESTIGATION OF TC-1 FLIGHT FAILURE USING POWER SPECTRAL ANALYSIS
Carl F. Lorenzo Jul. 1976 34 p ref
(NASA-TM-X-71914; E-8717) Avail: NTIS HC $4.00 CSCL 22D

During the Titan Centaur 1 test flight a failure involving at least one of the Centaur propellant boost pumps occurred. Also, neither of the boost pump speed instruments indicated pump rotation. Accelerometer data from the Titan Centaur 1 flight failure were analyzed using power spectral density methods to determine boost pump speed during attempted starts of the Centaur. The technique was demonstrated on a reference flight. The hydrogen boost pump speed transient was determined for the TC-1 flight. Other trends are seen in the data. However, these are not believed to be the oxygen boost pump. Discussion of data enhancement techniques is also presented. Author

N76-30256*# Boeing Co., Seattle, Wash.
LARGE DIAMETER SHUTTLE LAUNCHED-AEM (LDSL-AEM) STUDY Final Report
28 Apr. 1976 114 p Original contains color illustrations
(Contract NAS5-23537)
(NASA-CR-144797; D268-10656-1) Avail: NTIS HC $5.50 CSCL 22B

A technical description of a Large Diameter Shuttle Launched-AEM (LDSL-AEM), an AEM base module adapted to carry 5 ft diameter payloads in the shuttle with propulsion for carrying payloads to higher altitude orbits from a 150 NM shuttle orbit, is described. The AEM is designed for launch on the scout launch vehicle. Onboard equipment provides capability to despin, acquire the earth, and control the vehicle in an earth pointing mode using reaction wheels for torque with magnets for all attitude acquisition, wheel desaturation, and nutation damping. Earth sensors in the wheels provide pitch and roll attitude. This system provides autonomous control capability to 1 degree in pitch and roll and 2 degrees in yaw. The attitude can be determined to .5 degrees in pitch and roll and 2 degrees in yaw. Author

N76-30257*# Rutgers Univ., New Brunswick, N.J.
RUTGERS ZODIACAL LIGHT EXPERIMENT ON OSO-6 Final Report
Benjamin Carroll 10 Dec. 1975 92 p refs
(Contract NAS5-9276)
(NASA-CR-144798) Avail: NTIS HC $5.00 CSCL 22B

A detector was placed in a slowly spinning wheel on OSO-6 whose axis was perpendicular to the line drawn to the sun, to measure the surface brightness and polarization at all elongations from the immediate neighborhood of the sun to the anti-solar point. Different wavelength settings and polarizations were calculated from the known order of magnitude brightness of the zodiacal light. The measuring sequence was arranged to give longer integration times for the regions of lower surface brightness. Three types of analysis to which the data on OSO-6 were subjected are outlined; (1) photometry, (2) colorimetry and (3) polarimetry. B.B.

N76-30258*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLAR RADIATION PRESSURE EFFECTS ON THE HELIOS SPACECRAFT
R. M. Georgevic 15 Jul. 1976 51 p refs
(Contract NAS7-100)
(NASA-CR-148758; JPL-TM-33-778) Avail: NTIS HC $4.50 CSCL 22B

A mathematical model of the solar radiation force and torques, developed for the Mariner 10 Venus/Mercury spacecraft mission, was used for a detailed analysis of the effects of solar light pressure on the Helios spacecraft. Due to the fact that the main body of the Helios spacecraft is a surface of enclosure, inside of which most of the reradiated thermal energy is lost, expressions for the portion of the solar radiation force, produced by the thermal reradiation, had to be given a different form. Hence the need for the derivation of a somewhat different theoretical model for the force acting on the main body of the spacecraft. Author

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N76-30259*# Aerospace Corp., El Segundo, Calif.
STS USERS STUDY (STUDY 2.2). VOLUME 3: ANCILLARY EQUIPMENT STUDY Final Report
Ernest I. Pritchard 1 Nov. 1975 160 p refs
(Contract NASw-2727)
(NASA-CR-148716; ATR-75(7362)-1-Vol-3) Avail: NTIS HC $6.75 CSCL 22B

The multi-mission support equipment (MMSE) applicable to six payloads is studied. Tables indicate individual satellite projects to which each MMSE is applicable, and which equipments are applicable to multiple payload configurations when more than one project's payload would be flown on the STS. An estimate of the first date on which interface definition information needed by a payload project are also shown. Author

N76-30260*# Aerospace Corp., El Segundo, Calif. Systems Engineering Operations.
SHUTTLE USER ANALYSIS (STUDY 2.2). VOLUME 2: USER CHARGE ANALYSIS. PART 1: SUMMARY Final Report
30 Sep. 1974 40 p 4 Vol.
(Contract NASw-2757)
(NASA-CR-148706; ATR-74(7342)-1-Vol-2-Pt-1) Avail: NTIS HC $4.00 CSCL 22B

Alternative candidate STS flight charge approaches which will provide a basis for NASA's determination of an STS flight charge policy were analyzed. The analysis used STS transportation costs furnished by NASA. The STS User Charge Analysis was accomplished by (1) generating criteria for evaluation of alternative flight charge approaches, (2) defining alternative flight charge approaches, (3) computing flight charges for selected missions, (4) evaluating results using the criteria generated under (1), and (5) recommending flight charge approaches to be used as a basis for the formulation of a STS user flight charge policy.
Author

N76-30261*# Aerospace Corp., El Segundo, Calif. Systems Engineering Operations.
SHUTTLE USER ANALYSIS (STUDY 2.2). VOLUME 3: BUSINESS RISK AND VALUE OF OPERATIONS IN SPACE (BRAVO). PART 2: USER'S MANUAL Final Report
30 Sep. 1974 261 p refs 4 Vol.
(Contract NASw-2575)
(NASA-CR-148707; ATR-74(7342)-1-Vol-3-Pt-2) Avail: NTIS HC $9.00 CSCL 22B

The purpose of the BRAVO User's Manual is to describe the BRAVO methodology in terms of step-by-step procedures. The BRAVO methodology then becomes a tool which a team of analysts can utilize to perform cost effectiveness analyses on potential future space applications with a relatively general set of input information and a relatively small expenditure of resources. An overview of the BRAVO procedure is given by describing the complete procedure in a general form. Author

N76-30262*# Aerospace Corp., El Segundo, Calif.
STS USERS STUDY (STUDY 2.2). VOLUME 1: EXECUTIVE SUMMARY Final Report
Ernest I. Pritchard 1 Nov. 1975 26 p refs
(Contract NASw-2727)
(NASA-CR-148720; ATR-76(7362)-1-Vol-1) Avail: NTIS HC $4.00 CSCL 22B

The space transportation system (STS) and ancillary equipment user studies are presented. Space shuttle data and planning requirements needed by the STS user are discussed along with the potential for common usage of multi-mission support equipment by the military and other aerospace personnel. B.B.

N76-30263*# Aerospace Corp., El Segundo, Calif.
STS USERS STUDY (STUDY 2.2). VOLUME 2: STS USERS PLAN (USER DATA REQUIREMENTS) STUDY Final Report
E. I. Pritchard 1 Nov. 1975 378 p
(Contract NASw-2727)
(NASA-CR-148721; ATR-76(7362)-1-Vol-2) Avail: NTIS HC $10.75 CSCL 22B

Pre-flight scheduling and pre-flight requirements of the space transportation system are discussed. Payload safety requirements, shuttle flight manifests, and interface specifications are studied in detail. B.B.

N76-30264*# Aerospace Corp., El Segundo, Calif. Systems Engineering Operations.
SHUTTLE USER ANALYSIS (STUDY 2.2). VOLUME 3: BUSINESS RISK AND VALUE OF OPERATIONS IN SPACE (BRAVO). PART 1: SUMMARY Final Report
30 Sep. 1974 19 p refs 4 Vol.
(Contract NASw-2757)
(NASA-CR-148705; ATR-74(7432)-1-Vol-3-Pt-1) Avail: NTIS HC $3.50 CSCL 22B

The approach used in the study, the operation of the various analytical procedures, and the development and testing of BRAVO are described. Author

N76-30265*# Chrysler Corp., New Orleans, La. Space Div.
TERMINAL AREA ENERGY MANAGEMENT REGIME INVESTIGATIONS UTILIZING AN 0.030-SCALE MODEL (47-0) OF THE SPACE SHUTTLE VEHICLE ORBITER CONFIGURATION 140A/B/C/R IN THE AMES RESEARCH CENTER 11 X 11 FOOT TRANSONIC WIND TUNNEL (OA148), VOLUME 5
P. J. Hawthorne (Rockwell Intern., Downey, Calif.) Jul. 1976 694 p refs 13 Vol.
(Contract NAS9-13247)
(NASA-CR-144623; DMS-DR-2254-Vol-5) Avail: NTIS HC $16.25 CSCL 22B

Data obtained in wind tunnel test OA148 are presented. The objectives of the test series were to: (1) obtain pressure distributions, forces and moments over the vehicle 5 orbiter in the thermal area energy management (TAEM) and approach phases of flight; (2) obtain elevon and rudder hinge moments in the TAEM and approach phases of flight; (3) obtain body flap and elevon loads for verification of loads balancing with integrated pressure distributions; and (4) obtain pressure distributions near the short OMS pods in the high subsonic, transonic and low supersonic Mach number regimes. Author

N76-30266*# Chrysler Corp., New Orleans, La. Space Div.
TERMINAL AREA ENERGY MANAGEMENT REGIME INVESTIGATIONS UTILIZING AN 0.030-SCALE MODEL (47-0) OF THE SPACE SHUTTLE VEHICLE ORBITER CONFIGURATION 140A/B/C/R IN THE AMES RESEARCH CENTER 11 X 11 FOOT TRANSONIC WIND TUNNEL (OA148), VOLUME 6
P. J. Hawthorne (Rockwell Intern., Downey, Calif.) Jul. 1976 676 p refs 13 Vol.
(Contract NAS9-13247)
(NASA-CR-144624; DMS-DR-2254-Vol-6) Avail: NTIS HC $16.25 CSCL 22B

Plots and tabular listings are presented for both force and pressure data for the lower wing. J.M.S.

N76-30267*# Chrysler Corp., New Orleans, La. Space Div.
TERMINAL AREA ENERGY MANAGEMENT REGIME INVESTIGATIONS UTILIZING AN 0.030-SCALE MODEL (47-0) OF THE SPACE SHUTTLE VEHICLE ORBITER CONFIGURATION 140A/B/C/R IN THE AMES RESEARCH CENTER 11 X 11 FOOT TRANSONIC WIND TUNNEL (OA148), VOLUME 7
P. J. Hawthorne (Rockwell Intern., Downey, Calif.) Jul. 1976 729 p refs 13 Vol.
(Contract NAS9-13247)
(NASA-CR-144625; DMS-DR-2254-Vol-7) Avail: NTIS HC $18.75 CSCL 22B
For abstract, see Vol. 6.

N76-30268*# Chrysler Corp., New Orleans, La. Space Div.
TERMINAL AREA ENERGY MANAGEMENT REGIME INVESTIGATIONS UTILIZING AN 0.030-SCALE MODEL (47-0) OF THE SPACE SHUTTLE VEHICLE ORBITER CONFIGURATION 140A/B/C/R IN THE AMES RESEARCH CENTER 11 X 11 FOOT TRANSONIC WIND TUNNEL (OA148), VOLUME 8
P. J. Hawthorne (Rockwell Intern. Corp., Downey, Calif.) Jul. 1976 668 p refs
(Contract NAS9-13247)
(NASA-CR-144626; DMS-DR-2254-Vol-8) Avail: NTIS HC $16.25 CSCL 22B
For abstract, see Vol. 6.

N76-30269*# Chrysler Corp., New Orleans, La. Space Div.
TERMINAL AREA ENERGY MANAGEMENT REGIME INVESTIGATIONS UTILIZING AN 0.030-SCALE MODEL (47-0) OF THE SPACE SHUTTLE VEHICLE ORBITER CONFIGURATION 140A/B/C/R/ IN THE AMES RESEARCH CENTER 11 X 11 FOOT TRANSONIC WIND TUNNEL (OA148), VOLUME 9
P. J. Hawthorne (Rockwell Intern. Corp., Downey, Calif.) Jul. 1976 800 p refs
(Contract NAS9-13247)
(NASA-CR-144627; DMS-DR-2254-Vol-9) Avail: NTIS HC $18.75 CSCL 22B

Plots and tabular listings are presented for both force and pressure data for the upper wing. J.M.S.

N76-30270*# Chrysler Corp., New Orleans, La. Space Division.
TERMINAL AREA ENERGY MANAGEMENT REGIME INVESTIGATIONS USING AN 0.030-SCALE MODEL (47-0) OF THE SPACE SHUTTLE VEHICLE ORBITER CONFIGURATION 140A/B/C/R IN THE AMES RESEARCH CENTER 11 X 11 FOOT TRANSONIC WIND TUNNEL (OA148), VOLUME 10
P. J. Hawthorne (Rockwell Intern. Corp., Downey, Calif.) [1976] 891 p refs 13 Vol.
(Contract NAS9-13247)
(NASA-CR-144628; DMS-DR-2254-Vol-10) Avail: NTIS HC $21.25 CSCL 22B
For abstract, see Vol. 9.

N76-30271*# Chrysler Corp., New Orleans, La. Space Div.
TERMINAL AREA ENERGY MANAGEMENT REGIME INVESTIGATIONS UTILIZING AN 0.030-SCALE MODEL (47-0) OF THE SPACE SHUTTLE VEHICLE ORBITER CONFIGURATION 140A/B/C/R IN THE AMES RESEARCH CENTER 11 BY 11 FOOT TRANSONIC WIND TUNNEL (OA148), VOLUME 11
P. J. Hawthorne (Rockwell Intern. Corp., Downey, Calif.) Jul. 1976 863 p refs 13 Vol.
(Contract NAS9-13247)
(NASA-CR-147601; DMS-DR-2254-Vol-11) Avail: NTIS HC $21.25 CSCL 22B
For abstract, see Vol. 9.

N76-30272*# Chrysler Corp., New Orleans, La. Space Div.
TERMINAL AREA ENERGY MANAGEMENT REGIME INVESTIGATIONS UTILIZING AN 0.030-SCALE MODEL (47-0) OF THE SPACE SHUTTLE VEHICLE ORBITER CONFIGURATION 140A/B/C/R IN THE AMES RESEARCH CENTER 11 X 11 FOOT TRANSONIC WIND TUNNEL (OA148), VOLUME 12
P. J. Hawthorne (Rockwell Intern. Corp., Downey, Calif.) Jul. 1976 800 p refs 13 Vol.
(Contract NAS9-13247)
(NASA-CR-147602; DMS-DR-2254-Vol-12) Avail: NTIS HC $18.75 CSCL 22B
Plots and tabular listings are presented for both force and pressure data for the upper and lower body flap. J.M.S.

N76-30273*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF AN INVESTIGATION OF REYNOLDS EFFECTS ON INTEGRATED VEHICLE ELEVON HINGE MOMENTS AND WING PANEL LOADS OBTAINED WITH 0.010 SCALE MODEL 72 OTS IN THE ROCKWELL TRISONIC WIND TUNNEL (IA141)
R. C. Mennell (Rockwell Intern., Los Angeles, Calif.) Aug. 1976 172 p
(Contract NAS9-13247)
(NASA-CR-147623; DMS-DR-2315) Avail: NTIS HC $6.75 CSCL 22B
Wind tunnel investigations were conducted on an 0.010-scale representation of the VL70-000140C Integrated Space Shuttle Launch Vehicle. The primary test objective was to obtain Reynolds number effects on orbiter elevon hinge moments and wing bending/torsional moments. Launch vehicle aerodynamic force data were also recorded. The elevon hinge moments, wing bending/torsional moments, and vehicle force data were recorded over an angle of attack range of -6 deg to +6 deg, an angle of sideslip range of -6 deg to +6 deg, at Mach numbers of 0.6, 0.975, 1.05 and 1.25. The Reynolds number was varied from a minimum of 4.5 million/foot to a maximum of 11.5 million/foot. The complete integrated configuration was tested with the orbiter elevons set at 0 deg and deflected to 9 deg on the outboard elevon and 10 deg on the inboard elevon. Testing was conducted in the TWT 19.7% porous transonic test section with the model sting mounted through the orbiter base. All aerodynamic force data were obtained from internal strain gage balance located in the orbiter. Author

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N76-30274*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING X-BAND TELEMETRY EXPERIMENT Final Report
William J. Weber, III, William E. Ackerknecht, III, and Frank J. Kollar 1 Sep. 1976 54 p ref
(Contract NAS7-100)
(NASA-CR-148759; JPL-TM-33-794) Avail: NTIS HC $4.50 CSCL 17B
In order to uncover operational and design problems in the use of X-band by the 1977 Mariner Jupiter-Saturn mission and future spacecraft using the Deep Space Network, the Viking X-band telemetry experiment was conducted. The experiment was conducted during the months of December 1975 and January 1976. During each of the five successful passes, a periodic sequence (in lieu of ranging) was transmitted to the spacecraft and returned by the spacecraft transponder on both S- and X-bands. These telemetry-like signals were received, demodulated, and detected. From a variety of measurements at the station, four independent measurements were made of the received signal-to-noise ratio (SNR). These four SNRs were later compared with each other and the predicted SNR. The principal result of the experiment is that X-band telemetry works as expected. That is, the measured SNRs were consistent relative to each other and to the predicted values within the accuracy of the experiment. Author

N76-30275# Rockwell International Corp., Anaheim, Calif. Missile Systems Div.
ELECTRO-OPTICAL SURVEILLANCE AT CLOUDCROFT: ENGINEERING MODIFICATIONS Final Report, 1 Mar. 1973 - 30 Sep. 1975
J. L. Lahr and A. L. Jarvis Wright-Patterson AFB, Ohio AFAL Dec. 1975 97 p refs
(Contract F33615-73-C-1178; AF Proj. 7660)
(AD-A022149; C73-721/034A; AFAL-TR-75-237) Avail: NTIS CSCL 17/7
Several major efforts were completed for the Electro Optical Research Facility at Cloudcroft, New Mexico, with the objectives of updating and improving the facility. The significance of these efforts to the Air Force is that important new technical capabilities have been achieved for conducting in-house laboratory R and D on electro-optical and infrared sensor and data processing techniques for aerospace surveillance. This will enable the Cloudcroft E/O facility to better support Technical Needs and Required Operational Capabilities of AFSC Systems Divisions and AF Operational Commands. These efforts included design, fabrication, and installation of a photometer/TV camera mount, safety door actuators and focus test apertures, and a radiometer mount. A plan was developed for overhaul of the 48-in. telescope and a mathematical pointing error model was made. Installation of a solid state servo control system was made and considerable software was developed for real time telescope control using the IBM computer. Author (GRA)

N76-30276# Washington Univ., Seattle.
ATS-6 HEALTH EXPERIMENT: INDIAN HEALTH SERVICE/ALASKA WAMI EXPERIMENT IN REGIONALIZED MEDICAL EDUCATION/SEATTLE, WASHINGTON. PHASE 2: OPERATIONS Technical Report, 30 Sep. 1974 - 15 May 1975
Dec. 1975 39 p
(Contract PHS-CG-73-2003)
(PB-250421/5; NLM/LHC-75/08) Avail: NTIS HC $4.00 CSCL 06E
A review is presented of the operational phase of the ATS-6 Health-Education Telecommunications Experiments. The Indian Health Service developed a system of coordinated telemedicine and health information experiments involving five health care

facilities. Through interactive television and biomedical telemetry, health aides at two village clinics consulted with physicians at a service unit hospital in Tanana, and with specialists at the Alaska Native Medical Center in Anchorage. A backup station was maintained in Fairbanks. The WAMI Experiment incorporated two distinct parts: the 'University' of basic science phase and the 'Community' or clinical phase. Administrators, students, and faculty at the University of Washington were linked to their counterparts at the University of Alaska in Fairbanks and to the Community Clinical Unit at Omak, Washington by interactive video, audio, and data communications. GRA

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N76-30277 Washington Univ., Seattle.
A NON-LIMIT-CYCLE DIGITAL COMPUTER ALGORITHM FOR PULSED ATTITUDE CONTROL OF A FLEXIBLE SPACECRAFT Ph.D. Thesis
David Lawrence Quam 1975 133 p
Avail: Univ. Microfilms Order No. 76-17593

A new control scheme is presented for pulsed attitude control of a flexible spacecraft. The design problem of determining a fuel efficient digital computer algorithm for an on-board computer controlling spacecraft attitude with only a single set of solenoid-valved reaction gas jets is discussed. Previous methods of feedback attitude control with pulsed reaction jets have resulted in limit cycle oscillations. For rigid spacecraft the limit cycle frequency can be made sufficiently low such that both attitude error and fuel consumption are reasonably small. However as spacecraft flexibility increases, the oscillatory motion is more likely to cause premature firing of the reaction jets, thereby greatly increasing fuel consumption. The No-Limit-Cycle Algorithm is exhibited and described in detail. Two convergence proofs are presented. Computer simulations of typical spacecraft trajectories are also presented. A reorientation cycle is exhibited and some trajectories with errors beyond the allowable limits show nonconvergence. Dissert. Abstr.

N76-30278*# Chrysler Corp., New Orleans, La. Space Div.
TRANSITION HEATING RATES DETERMINED ON A 0.006 SCALE SPACE SHUTTLE ORBITER MODEL (NO. 50-0) IN THE NASA/LARC MACH 8 VARIABLE DENSITY WIND TUNNEL TEST (OH14)
J. Cummings (Rockwell Intern. Corp., Downey, Calif.) Aug. 1976 619 p refs
(Contract NAS9-13247)
(NASA-CR-147617; DMS-DR-2117) Avail: NTIS HC $16.25 CSCL 22B

Data obtained from wind tunnel tests of an .006-scale space shuttle orbiter model in the 18 in. Variable Density Wind Tunnel are presented. The tests, denoted as OH14, were performed to determine transition heating rates using thin skin thermocouples located at various locations on the space shuttle orbiter. The model was tested at M = 8.0 for a range of Reynolds numbers per foot varying from 1.0 to 10.0 million with angles-of-attack from 20 to 35 degrees incremented by 5 degrees. Author

N76-30279*# Teledyne Brown Engineering, Huntsville, Ala. Systems Analysis Dept.
LOW FLUXES OF X-RAYS Final Report
Feb. 1976 8 p refs
(Contract NAS8-26342)
(NASA-CR-149984; MS-MSFC-1975) Avail: NTIS HC $3.50 CSCL 22B

Analytic and experimental investigations of the interactions of high-energy protons with spacecraft materials and light nucleus atoms were conducted. Irradiation of typical materials for scintillation detectors using accelerator-produced energetic protons and associated theoretical calculations indicate activity within detectors produced by this mechanism is significant to detection of low-level cosmic gamma radiation. Samples of several materials were flown aboard Skylab to obtain measures of the neutron and proton flux environment. Extremely weak activity was produced in the samples. Calculations of interactions of intermediate-energy protons with light nuclei were performed and a more complete theoretical model programmed for digital computation. Preliminary results appear promising for calculating products of such interactions. Author

N76-30280*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
REQUIREMENTS AND CAPABILITIES FOR PLANETARY MISSIONS. VENUS ORBITER IMAGING RADAR 1983, VOLUME 3
D. H. Kindt, G. G. Ball, and T. H. Bird Aug. 1976 9 p refs
(Contract NAS7-100)
(NASA-CR-148734; JPL-SP-43-27-Vol-3) Avail: NTIS HC $3.50 CSCL 22B

Two spacecraft will be launched in mid-1983 and inserted into a circular polar orbit around Venus about 6 months later. Elliptical orbits are also under consideration. The objective of the mission is imagery of the planet, at about the 200-m resolution level, with continuous altimetry and topographical studies. Science investigations will determine surface characteristics of the planet, study the surface/atmosphere interactions, and determine Venus' mass distribution. A plausible vehicle is based on a Mariner Jupiter/Saturn derivative; others being considered include a Lunar Polar Orbiter derivative and a Pioneer Venus Orbiter derivative. Author

N76-30281# Royal Aircraft Establishment, Farnborough (England).
FLIGHT PERFORMANCE OF THE SKYLARK SL1011 STAR POINTING ATTITUDE CONTROL SYSTEM
C. T. Farr Dec. 1975 57 p refs
(RAE-TR-75110; BR50224) Avail: NTIS HC $4.50

The star pointing attitude control system developed for the Skylark rocket is described. Possible sources of error (magnetic, moon, inertial errors, star pointing errors) which could affect the flight performance of the unit are reviewed, and the accuracies in fact achieved with it during the flight of Skylark SL1011 are analyzed. Certain limitations of the system are pointed out and practicable possible solutions suggested. Author (ESA)

N76-30282# Royal Aircraft Establishment, Farnborough (England).
OPERATIONAL EXPERIENCE OF THE MIRANDA (X4) SATELLITE ATTITUDE CONTROL SYSTEM
W. G. Hughes Nov. 1975 54 p refs
(RAE-TR-75116; BR50046) Avail: NTIS HC $4.50

The three-axis attitude control system of the British technological satellite Miranda (X4) is briefly described and its performance assessed. The short-term attitude reference is obtained from a set of strap-down integrating rate gyroscopes. Control torquing is provided by a cold-gas stored-liquid propane jet system. Novel signal processing is used to provide a high quality of limit-cycle operation. In two axes the inertial reference is updated by a fine sun sensor. In the third axis, normal operation involves solely the gyroscope reference, but provision is made to update to a stellar reference, using an experimental star sensor. Despite some malfunction of the gas pressure regulation, the satellite has achieved its experimental objectives. Author (ESA)

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N76-30283*# Aerotherm Acurex Corp., Mountain View, Calif.
DEVELOPMENT OF TPS FLIGHT TEST AND OPERATIONAL INSTRUMENTATION Final Report
K. R. Carnahan, G. J. Hartman, and G. J. Neuner Jan. 1975

139 p refs
(Contract NAS9-13543)
(NASA-CR-147845; Aerotherm-FR-75-135) Avail: NTIS HC $6.00 CSCL 14B

Thermal and flow sensor instrumentation was developed for use as an integral part of the space shuttle orbiter reusable thermal protection system. The effort was performed in three tasks: a study to determine the optimum instruments and instrument installations for the space shuttle orbiter RSI and RCC TPS; tests and/or analysis to determine the instrument installations to minimize measurement errors; and analysis using data from the test program for comparison to analytical methods. A detailed review of existing state of the art instrumentation in industry was performed to determine the baseline for the departure of the research effort. From this information, detailed criteria for thermal protection system instrumentation were developed.

Author

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N76-30284*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LIQUID ROCKET ENGINE INJECTORS
G. S. Gill (Rockwell Intern. Corp.) and W. H. Nurick (Rockwell Intern. Corp.) Mar. 1976 13[illegible] refs
(NASA-SP-8089) Avail: NTIS HC $6.00 CSCL 21H

The injector in a liquid rocket engine atomizes and mixes the fuel with the oxidizer to produce efficient and stable combustion that will provide the required thrust without endangering hardware durability. Injectors usually take the form of a perforated disk at the head of the rocket engine combustion chamber, and have varied from a few inches to more than a yard in diameter. This monograph treats specifically bipropellant injectors, emphasis being placed on the liquid/liquid and liquid/gas injectors that have been developed for and used in flight-proven engines. The information provided has limited application to monopropellant injectors and gas/gas propellant systems. Critical problems that may arise during injector development and the approaches that lead to successful design are discussed.

Author

N76-30285*# Cryogenic Consultants, Inc., Allentown, Pa.
FEASIBILITY STUDY OF LAUNCH VEHICLE GROUND CLOUD NEUTRALIZATION
P. C. VanderArend, S. T. Stoy, and T. E. Kranyecz 1 Jun. 1976 150 p refs
(Contract NAS1-13973)
(NASA-CR-145000) Avail: NTIS HC $6.00 CSCL 21I

The distribution of hydrogen chloride in the cloud was analyzed as a function of launch pad geometry and rate of rise of the vehicle during the first 24 sec of burn in order to define neutralization requirements. Delivery systems of various types were developed in order to bring the proposed chemical agents in close contact with the hydrogen chloride. Approximately one-third of the total neutralizing agent required can be delivered from a ground installed system at the launch pad; concentrated sodium carbonate solution is the preferred choice of agent for this launch pad system. Two-thirds of the neutralization requirement appears to need delivery by aircraft. Only one chemical agent (ammonia) may be reasonably considered for delivery by aircraft, because weight and bulk of all other agents are too large.

Author

N76-30286*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CENTAUR BOOST PUMP TURBINE ICING INVESTIGATION
R. J. Rollbuhler May 1976 29 p refs
(NASA-TM-X-73421; E-8759) Avail: NTIS HC $4.00 CSCL 21H

An investigation was conducted to determine if ice formation in the Centaur vehicle liquid oxygen boost pump turbine could prevent rotation of the pump and whether or not this phenomenon could have been the failure mechanism for the Titan/Centaur vehicle TC-1. The investigation consisted of a series of tests done in the LeRC Space Power Chamber Facility to evaluate evaporative cooling behavior patterns in a turbine as a function of the quantity of water trapped in the turbine and as a function of the vehicle ascent pressure profile. It was found that evaporative freezing of water in the turbine housing, due to rapid depressurization within the turbine during vehicle ascent, could result in the formation of ice that would block the turbine and prevent rotation of the boost pump. But for such icing conditions to exist it would be necessary to have significant quantities of water in the turbine and/or its components, and the turbine housing temperature would have to be colder than 40 F at vehicle liftoff.

Author

N76-30287# Royal Aircraft Establishment, Farnborough (England).
A SURVEY OF ELECTRIC PROPULSION RESEARCH AND DEVELOPMENT IN THE UK
D. G. Fearn Jun. 1975 49 p refs
(RAE-TR-75053; BR47904) Avail: NTIS HC $4.00

Despite increased concentration of resources in certain areas, electric propulsion activities in the U.K. still cover a wide field. Extensive work continues in basic physics and technology, and several thrusters are being studied in detail. The greatest effort is devoted to the RAE/Culham T4 ion thruster, which is intended for the north-south station keeping role on geostationary communications satellites. The City University is investigating fundamental processes in ion thrusters, and colloid devices continue to be studied at Southampton University. The Culham Laboratory is working on field emission thrusters under ESTEC sponsorship. Resistojets have been studied recently at the RAE, Southampton and Oxford Universities, and RPE, Westcott; however, emphasis is now on electrothermal hydrazine thrusters, particularly at HSD and the RAE, where gas plenum systems and augmented devices are also being studied. Work on mission analysis has continued at Westcott and Southampton.

Author (ESA)

N76-30288# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Propulsion Directorate.
EXPERIMENTAL COMBUSTOR FOR SOLID GAS GENERATORS
William M. Chew, O. E. Ayers, Pasquale Martignoni, and J. A. Murfree 15 Jul. 1975 14 p
(AD-A020467; RK-76-2) Avail: NTIS CSCL 13/7

This paper describes a simple experimental system used to evaluate various candidate solid gas generators. Parameters such as burning rates, gaseous and solid product compositions, and ignition characteristics can be obtained using this system. Examples of typical experimental results, as well as suggested improvements for getting optimum results from this system are given.

Author (GRA)

N76-30289# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Aeroballistics Directorate.
A BIBLIOGRAPHY OF PLUME EFFECTS INVESTIGATIONS CONDUCTED BY THE ARMY MISSILE COMMAND
George Batiuk Dec. 1975 29 p
(DA Proj. 1M3-62303-A-214)
(AD-A022132; RD-76-16) Avail: NTIS CSCL 21/8

This report summarizes all of the reports of plume effects investigations produced to date and presents them in a chronological order. The abstract and conclusions of each report are included.

Author (GRA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N76-30290# Institutul de Fizica Atomica, Bucharest (Romania).
CROSS SECTION CALCULATIONS BY THE COUPLED CHANNEL THEORY: A MODIFIED VERSION OF THE PROGRAM JUPITOR
S. Mateescu, E. Badescu, N. Dragan, and L. Pintiliescu 1975 16 p refs
(IFA-DNR-21-1975) Avail: ERDA Depository Libraries HC $3.50

The principles of the calculations by the coupled channel theory are presented. The particular steps of the cross sections, polarizations, and strength functions calculations by this theoretical model are given. Some modifications of the program JUPITOR are shown. The program and its characteristics are also described. In the last part of the paper, some output examples of the new version of the program are given. Author (NSA)

N76-30291# Texas Univ., Austin. Dept. of Chemistry.
THERMAL DECOMPOSITION OF METHANOL ADSORBED ON ALUMINA Interim Report, 1 May 1975 - 1 Feb. 1976
T. Matsushima and J. M. White 25 Feb. 1976 48 p refs
Submitted for publication
(Contract N00014-75-C-0922; NR Proj. 056-578)
(AD-A021167) Avail: NTIS CSCL 07/4

The kinetic behavior of methanol adsorbed on alumina powder was studied by thermal desorption and isotopic tracer techniques using an ultra high vacuum system. The isotopic composition of ethers desorbed after co-adsorption of CH3OH and CD3OD was investigated. In the presence of gas phase CD3OD, thermal desorption was examined from a substrate on which CH3OH had been preadsorbed. The reactivity of adsorbed methoxides is discussed and it is suggested that heterogeneity is induced by adsorption and/or desorption. Author (GRA)

N76-30292# Thames Polytechnic, London (England). School of Chemistry.
NEW POLYORGANOSILOXANES PREPARED FROM SILICATE MINERALS Annual Report No. 1, 1 Oct. 1974 - 30 Sep. 1975
B. R. Currell 1 Oct. 1975 38 p refs
(Contract DA-ERO-75-G-019; DA Proj. 1T1-61102-B-32D)
(AD-A021691) Avail: NTIS CSCL 07/3

Previous work has demonstrated the production of polyorganosiloxanes by the direct trimethylsilylation of inorganic mineral silicates. These polyorganosiloxanes have been shown to contain hydroxyl groups directly bonded to silicon. It was initially indicated that these hydroxyls may react with, for example, Ph2PCl, Me3SiCl and CH3COCl to give polyorganosiloxanes with bonded -OPPh2, OSiMe3 or -OCCH3 groups. Further investigation has shown that these reactions are complicated by side reactions involving reorganization of the siloxane backbone structures. It has also been shown that the hydroxyl content of these polyorganosiloxanes greatly depends on their method of preparation. Current work involves a detailed study of the reorganization reactions and of methods to produce polyorganosiloxanes with controlled hydroxyl contents. This work, which is expected to be completed in a few months, will then form a firm basis for the production of useful polymeric materials. Author (GRA)

N76-30293# Stanford Univ., Calif. Center for Materials Research.
LONG RANGE MATERIALS RESEARCH Semiannual Technical Report, 1 Jun. - 31 Dec. 1975
Robert A. Huggins Jan. 1976 202 p refs
(Contract N00014-75-C-1171; ARPA Order 3018)
(AD-A022116; SU-CMR-76-1) Avail: NTIS CSCL 07/4

The program is composed of four separate programs as follows: (1) Detection of X-Ray Radiation; (2) Superplasticity and Warm Working of Metals and Alloys; (3) Synthesis of New Types of Catalyst Materials; and (4) Development of Elevated Temperature Electrocrystallization Techniques. Progress in each of the subareas during this report period is described. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N76-30294 Pennsylvania State Univ., University Park.
STOICHIOMETRY EFFECTS ON THE FRACTURE OF RUTILE AND WUSTITE Ph.D. Thesis
William Paul Minnear 1975 210 p
Avail: Univ. Microfilms Order No. 76-17878

Specimens of rutile, 2.000 > O/Ti > 1.963 and Wustite, 1.096 > O/Fe > 1.066 were prepared by hot pressing and heat treatment of the appropriate powders. Large decreases in the elastic moduli and fracture surface energy of rutile, observed at lower O/Ti, were attributed to the crack-like character of the planar defect clusters. For Wustite, a small increase in the elastic moduli and hardness accompanied increased O/Fe. This change is explained by a Voight-Reuss average between the elastic moduli values for Fe-rich Wustite and magnetite. Two regimes of subcritical crack growth were observed in rutile: (1) essentially mechanical failure, explained by a model based on the combined effects of elastic anisotropy and stress corrosion, and (2) a stress corrosion phenomenon at the grain boundaries encouraged by an aqueous environment. No diffusional contributions to crack extension were thought to be observed.
Dissert. Abstr.

N76-30295*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FAILURE MECHANICS OF FIBER COMPOSITE NOTCHED CHARPY SPECIMENS
C. C. Chamis 1976 24 p ref Presented at the Army Symp. on Solid Mechanics, Composite Materials, and the Influence of Mechanics of Failure on Design, Cape Cod, Mass., 14-16 Sep. 1976
(NASA-TM-X-73462; E-8773) Avail: NTIS HC $3.50 CSCL 11D

A finite element stress analysis was performed to determine the stress variation in the vicinity of the notch and far field of fiber composites Charpy specimens (ASTM Standard). NASTRAN was used for the finite element analysis assuming linear behavior and equivalent static load. The unidirectional composites investigated ranged from Thornel 75 Epoxy to S-Glass/Epoxy with the fiber direction parallel to the long dimension of the specimen. The results indicate a biaxial stress state exists in (1) the notch vicinity which is dominated by transverse tensile and interlaminar shear and (2) near the load application point which is dominated by transverse compression and interlaminar shear. The results also lead to the postulation of hypotheses for the predominant failure modes, the fracture initiation, and the fracture process. Finally, the results indicate that the notched Charpy test specimen is not suitable for assessing the impact resistance of nonmetallic fiber composites directly. Author

N76-30296*# Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn.
FIBER COMPOSITE FAN BLADE IMPACT IMPROVEMENT Final Report
J. Graff, L. Stoltze, and E. M. Varholak Feb. 1976 77 p refs
(Contract NAS3-17837)
(NASA-CR-135001; HSER-6968) Avail: NTIS HC $5.00 CSCL 11D

The improved foreign object damage resistance of a metal matrix advanced composite fan blade was demonstrated. The fabrication, whirl impact test and subsequent evaluation of nine advanced composite fan blades of the 'QCSEE' type design were performed. The blades were designed to operate at a tip speed of 282 m/sec. The blade design was the spar/shell type, consisting of a titanium spar and boron/aluminum composite airfoils. The blade retention was designed to rock on impact with large birds, thereby reducing the blade bending stresses. The program demonstrated the ability of the blades to sustain impacts with up to 681 g slices of birds at 0.38 rad with little damage (only 1.4 percent max weight loss) and 788 g slices of birds at 0.56 rad with only 3.2 percent max weight loss. Unbonding did not exceed 1.1 percent of the post-test blade area during any of the tests. All blades in the post-test condition were judged

capable of operation in accordance with the FAA guidelines for medium and large bird impacts. Author

N76-30297*# Lehigh Univ., Bethlehem, Pa.
FRACTURE OF COMPOSITE PANELS
F. Erdogan and M. Bakioglu (Istanbul Technical Univ., Turkey) Feb. 1976 22 p refs
(Grant NGR-39-007-011)
(NASA-CR-145062) Avail: NTIS HC $3.50 CSCL 11D

The fracture problem in panels consisting of periodically arranged load carrying and buffer strips of different materials is considered. The main emphasis is placed on the problem of a crack terminating at and crossing the interfaces and on the stress free end problem. The problem is formulated in terms of a system of singular integral equations, and numerical solutions are obtained for certain material combinations. With the study of possible crack propagation and delamination in mind, certain stress intensity factors are defined and calculated. A main result is that when the crack touches or intersects a bimaterial interface, the stress state has no longer the standard square root singularity, and, to study further propagation of the crack, the conventional fracture models need to be modified, or new models need to be developed. Author

N76-30298*# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.
FRACTURE OF COMPOSITE ORTHOTROPIC PLATES FOR MATERIALS TYPE 2
Feridum Delale Mar. 1976 55 p refs
(Grants NGR-39-007-011; NsG-1178; NSF ENG-73-045053-A01)
(NASA-CR-145063) Avail: NTIS HC $4.50 CSCL 11D

The fracture problem of laminated plates which consist of orthotropic layers is considered. Symmetrical cracks are located normal to the bimaterial interfaces. The external loads are applied away from the crack region. Three cases are considered: (a) the case of internal cracks; (b) the case of broken laminates; and (c) case of a crack crossing the interface. A general formulation of the problem is given for plane strain and generalized plane stress cases. The singular behavior of stresses at the crack tips and at the interfaces is studied. In each case the stress intensity factors are computed for various crack geometries. Author

N76-30299*# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.
THE EFFECT OF ADHESIVE LAYER ON CRACK PROPAGATION IN LAMINATES
M. Rusen Gecit and F. Erdogan Mar. 1976 136 p refs
(Grant NGR-39-007-011)
(NASA-CR-145064) Avail: NTIS HC $6.00 CSCL 13M

The effect of the adhesive layer on crack propagation in composite materials is investigated. The composite medium consists of parallel load carrying laminates and buffer strips arranged periodically and bonded with thin adhesive layers. The strips, assumed to be isotropic and linearly elastic, contain symmetric cracks of arbitrary lengths located normal to the interfaces. Two problems are considered: (1) thin adhesive layers are approximated by uncoupled tension and shear springs distributed along the interfaces of the strips for which only the case of internal cracks can be treated rigorously; (2) broken laminates and the true singular behavior in the presence of the adhesive layer are studied. The adhesive is then treated as an isotropic, linearly elastic continuum. General expressions for field quantities are obtained in terms of infinite Fourier integrals. These expressions give a system of singular integral equations in terms of the crack surface displacement derivatives. By using appropriate quadrature formulas, the integral equations reduce to a system of linear algebraic equations which are solved numerically. Author

N76-30300# General Dynamics/Convair, San Diego, Calif.
COMPOSITE MATERIAL APPLICATION TO THE SHF SATCOM ANTENNA Final Report, 29 Sep. - 28 Dec. 1975
28 Dec. 1975 70 p refs
(Contract N00039-76-C-0117)
(AD-A022140; CASD-NAS-76-003) Avail: NTIS CSCL 09/5

A study was conducted by General Dynamics Convair Division on the application of advanced composite materials to the small ship SHF SATCOM antenna. Composites were studied because of their potential for significant weight savings on the weight-critical mast-located antennas, because of their inherent corrosion resistance, and because of the rapidly decreasing material and fabrication costs of advanced composite structures. Much of the composite technology developed in the aerospace industry in recent years has been demonstrated now on production aircraft programs like the Navy's F-14 and forthcoming F-18 carrier-based fighters, and in spacecraft antennas and structures. This composite technology was found in the study to be directly applicable to the Navy's shipboard SATCOM antennas. This study used as a baseline design, a four-foot variation of Configuration 'B' of the SHF SATCOM system described in Report N00123-72-C-0300 prepared by ITT. The substitution of composite materials in a composite configuration of that antenna, saved over 20% of the system weight, allowing a four-foot system to be designed for the weight of a three-foot system. In addition, the acquisition costs for the two systems were found to be very close, with the composite design being only slightly more costly to procure at today's costs. With the raw material costs of composites expected to match and go below the rising cost of conventional aluminum materials in the mid 1980s, an ultimate cost savings through the use of composites is expected. GRA

N76-30301# Los Alamos Scientific Lab., N.Mex.
HIGH DENSITY METALS AND METALLIC COMPOSITES FOR IMPROVED FRAGMENTATION SUBMUNITIONS
B. G. Craig, R. E. Honnell, G. F. Lederman, Jr., and D. J. Sandstrom Aug. 1975 26 p refs Sponsored in part by AMSAA
(Contract W-7405-eng-36)
(LA-6069-MS) Avail: NTIS HC $5.00

The fragmentation of ordnance cases (50.8-mm-id) made of tungsten, a tungsten alloy, and depleted uranium (D-38) was experimentally investigated. Velocities greater than 1 mm/mu s can be achieved for lethal size fragment weights. It is shown that fragmentation can be controlled by internal grooves, by internal screens, and by a spheroid-in-weak-matrix scheme. A thin polymer liner was used inside of a grooved tungsten case in one experiment; this system performed exceptionally well. The ease of fabricating cases with D-38 or with the tungsten-alloy spheroid-in-matrix scheme offers an attractive advantage over tungsten and tungsten alloys. NSA

N76-30302# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
ON THE ELASTIC MODULI OF UNIDIRECTIONAL FIBRE REINFORCED COMPOSITES
E. H. Mansfield London Aeron. Res. Council 1976 20 p refs Supersedes RAE-TR-74106 and ARC-35647
(ARC-R/M-3782; RAE-TR-74106; ARC-35647) Avail: NTIS HC $3.50; HMSO £2.30; PHI

A simple analytical technique based upon a direct method involving stress-equilibrium and strain-continuity considerations is presented for obtaining lower bounds to the effective moduli of unidirectional fiber-reinforced composites with any repetitive array of fibers. The composite is envisaged as being sliced along all 1,2 planes so that conditions of plane stress exist throughout and the stiffness properties of each vanishingly thin slice are readily determined in terms of the constituent properties of the fiber and matrix. The effective elastic moduli are obtained by suitable integration of such slice properties over a repeating fiber matrix pattern. Comparison with known accurate values of the longitudinal shear modulus shows that the technique underestimates the modulus by factors of about 1.1 for the square array and 1.2 for the hexagonal array, depending on the fiber volume fraction and fiber matrix stiffness ratio. By judicious use of such correction factors it should be possible to estimate the longitudinal shear modulus over a wide range of design parameters to within about 5 per cent; for the square and hexagonal arrays Symm's accurate but limited values have been augmented by new results which have an accuracy of 0.3 per cent. New results are also presented for the transverse modulus. Author (ESA)

N76-30303# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
THE CONCEPT OF LOAD DIFFUSION LENGTH IN FIBRE REINFORCED COMPOSITES
E. H. Mansfield and Doreen R. Best London Aeron. Res. Council

1976 25 p refs Supersedes RAE-TR-75032 and ARC-36110 (ARC-CP-1338; RAE-TR-75032; ARC-36110) Avail: NTIS HC $3.50; HMSO £1.50; PHI

The related problems of load diffusion and the decay of applied self-equilibrating stress systems in orthotropic sheets under conditions of plane stress are considered. Attention is focussed on the differences between the isotropic sheet and an orthotropic sheet with the properties of a fiber reinforced composite, particularly one with unidirectional or bi-directional reinforcement. A standard is defined for a load diffusion length and it is shown how this is influenced by anisotropy. Author (ESA)

N76-30304# Royal Aircraft Establishment, Farnborough (England). Structures Dept.

THE INFLUENCE OF FIBRE WAVINESS ON THE MODULI OF UNIDIRECTIONAL FIBRE REINFORCED COMPOSITES

E. H. Mansfield and D. Purslow London Aeron. Res. Council 1976 32 p refs Supersedes RAE-TR-74171 and ARC-36063 (ARC-CP-1339; RAE-TR-74171; ARC-36063) Avail: NTIS HC $4.00; HMSO £1.50; PHI

The effect of fiber waviness on the longitudinal shear and tensile moduli of unidirectional fiber reinforced composites is considered theoretically, while the degree of fiber waviness which occurs in practice is determined experimentally. Attention is concentrated on CFRP, but the analysis, albeit of an approximate nature, is quite general. Author (ESA)

N76-30305# Royal Aircraft Establishment, Farnborough (England).

THE USE OF TUBULAR TEST SPECIMENS FOR MATERIAL CHARACTERISATION OF FIBRE REINFORCED PLASTICS

J. B. Sturgeon Nov. 1975 46 p refs
(RAE-TR-75117; BR50047) Avail: NTIS HC $4.00

Theoretical studies on the use of tubular specimens to characterize fiber reinforced plastic materials were reviewed. Results of a shell theory analysis of tubular carbon fiber reinforced plastics (CFRP) are presented. These show that CFRP tubes yield uniform stress distributions in the center of the specimen and so may be used to characterize the material. In particular, tubes produced with axially oriented and hoop-wound fibers give a very uniform stress distribution and can be used for combined loading experiments. Author (ESA)

N76-30306# Pennsylvania State Univ., University Park. Dept. of Engineering Science and Mechanics.

RESEARCH SUMMARY ON THERMO-MECHANICAL BEHAVIOR OF COMPOSITE MATERIALS Final Report. 1 Oct. 1973 - 31 Dec. 1975

Jaan Kiusalaas Jan. 1976 13 p refs
(Grant AF-AFOSR-2590-74)
(AD-A023043; AFOSR-76-0297TR) Avail: NTIS CSCL 20/11

The report contains a summary of the research supported by the grant. The main objective of the work was to develop two-dimensional continuum theories of microstructure for the stress analysis of laminated composites under in-plane loading. Particular emphasis was placed on edge-effects. Author (GRA)

N76-30307# Materials Sciences Corp., Blue Bell, Pa.

EVALUATION OF HYBRID COMPOSITE MATERIALS Final Report, Jul. 1974 - Jun. 1975

S. V. Kulkarni, B. Walter Rosen, and H. C. Boehm Wright-Patterson AFB, Ohio AFML Jun. 1975 116 p refs
(Contract F33615-74-C-5174)
(AD-A021688; TFR-507; AFML-TR-75-92) Avail: NTIS CSCL 11/4

An examination of the available fiber prepregs clearly suggests that the higher stiffness and strength materials such as boron and graphite have higher price levels than the lower stiffness and strength prepregs such as Kevlar-49 and S-Glass. A logical outcome of this observation is to combine the two categories of fibers into hybrids so that the price levels can be brought down, perhaps at the expense of some strength and stiffness properties. The goal of such hybridization is to make composite materials more competitive with metals such as aluminum and titanium. In this report, a methodology is presented to obtain minimum cost and weight configurations for simple structural configurations which are representative of 'real world' structures, over a practical range of loadings. Weight differences are incorporated into the cost comparisons through the use of a premium cost to quantify the value of weight savings. Material costs, manufacturing costs and premiums are all treated as variables in this design study. GRA

N76-30308# Lehigh Univ., Bethlehem, Pa. Inst. of Fracture and Solid Mechanics.

STRESS INTENSITY FACTOR FOR A THREE-LAYERED PLATE WITH A CRACK IN THE CENTER LAYER Final Report

E. P. Chen and G. C. Sih Aug. 1975 57 p refs
(Contract N62269-74-C-0638)
(AD-A022117; IFSM-75-70) Avail: NTIS CSCL 11/4

The objective of this study is to model the laminated composite as a multilayered plate, each layer being made of a different material. With a crack in the mid-layer of the laminate, the stresses can vary in all three space coordinate directions and the problem is recognized as a three-dimensional one. A laminate plate theory is developed by application of the minimum complementary energy theorem in variational calculus such that the qualitative three-dimensional character of the crack edge stresses is retained while approximations are made in a quantitative sense on the stress intensity factor. Numerical values of the stress intensity factors for different construction of the laminate are reported and compared with the same size plate made of a single homogeneous material. GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N76-30309 Wisconsin Univ., Madison.

COMPUTER-AIDED SYNTHESIS OF CHEMICAL REACTION ROUTES BY MEANS OF SOLVAY CLUSTERS Ph.D. Thesis

Dror May 1976 114 p
Avail: Univ. Microfilms Order No. 76-16001

A computer method for the synthesis of industrially important chemical reaction routes is presented. The basic strategy of employing Solvay clusters as a means to accomplish infeasible chemical transformations was inferred from the Solvay soda ash process. This veteran process is the classic example for replacing an infeasible chemical reaction by a cluster of feasible reactions involving the closed-cycle use of intermediate compounds. Stoichiometry and thermodynamics are the basic concepts used for generating a set of feasible Solvay clusters. The selection of a sub-class of superior Solvay clusters is based on a figure of merit that heuristically can account for additional factors like rapid reaction rates, easy separation, safety and the like. The complex system of intermediate species and interdependent reactions was portrayed as a reaction network. Some known and original graph-theoretic algorithms are the basis of a computer program, which is described, that selects the best Solvay clusters. Dissert. Abstr.

N76-30310 California Univ., Berkeley.

FAR INFRARED SPECTROSCOPY OF SOLIDS. 1: IMPURITY STATES IN Al2O3. 2: ELECTRONHOLE DROPLETS IN Ge Ph.D. Thesis

Richard Lawrence Aurbach 1975 227 p
Avail: Univ. Microfilms Order No. 76-15102

Far infrared Fourier transform spectroscopy was used to study the low lying vibronic states of Mn(3+) in Al2O3 and the plasma absorption of electron-hole droplets in Ge. The transmission of Mn-doped samples of Al2O3 was measured in the frequency range from 3-30 cm to the -1 power in applied magnetic fields up to 50 kG. Absorption lines were observed due to both ground and excited state transitions. Polarization measurements established that these absorption lines were due to electric dipole transitions. Temperature dependence measurements were used to derive a level diagram for the low lying states of Mn(3+). A

phenomenological model based on an electronic Hamiltonian was developed which successfully describes the data. The empirically determined trigonal field and spin-orbit quenching parameters of this model are 0.7 and 0.1 respectively. Dissert. Abstr.

N76-30311 Fordham Univ., New York.
LASER RAMAN SPECTROSCOPY OF GASES. THE ROTATIONAL SPECTRA OF SOME CYCLIC MOLECULES Ph.D. Thesis
Jacob Varghese Kainnady 1976 215 p
Avail: Univ. Microfilms Order No. 76-17886

Rotational Raman spectra of some cyclic molecules (benzene, borazine, cyclo-propane, -pentane, -heptane and -octane) are studied. An argon ion laser was used to excite the spectra which were photographed with a plane grating spectrograph employing a 300 groove/mm grating. The rotational Raman spectrum of carbon monoxide was investigated as a test to determine the accuracy with which the molecular constants can be determined by this technique. It is found that, in favorable cases, the technique employed is able to provide the B-values which are accurate to one part in 1 million, and the centrifugal distortion constant can be determined to within 0.3%. Dissert. Abstr.

N76-30312 Pennsylvania State Univ., University Park.
DESIGN PARAMETERS FOR FLUIDIZED BED PROCESSORS AND NATURAL GAS COMBUSTORS Ph.D. Thesis
William Edward Cole 1975 209 p
Avail: Univ. Microfilms Order No. 76-18378

Natural gas was burned with air in a fluidized bed of 1.4 square foot cross sectional area and 0.5 to 6 inches thick. The bed material was blown alumina sized between 14 and 16 A.S.T.M. mesh and the natural gas and air were supplied to the bed premixed. It was found that a fixed bed of 3 to 5 A.S.T.M. mesh beneath the fluidized bed served as an excellent distributor system. A procedure for igniting the bed was developed which reduced the time necessary to reach stable operating conditions from several hours to several minutes. The behavior of the combustion reaction was studied by observation of the extinction and relight limits of the bed as well as flue gas analyses and temperature measurements. The extinction limits of the bed were determined as a function of bed thickness to diameter ratio, excess air ratio, and superficial velocity. Dissert. Abstr.

N76-30313 Pennsylvania State Univ., University Park.
FRAGMENTATION AND EXCITATION IN MICROWAVE-INDUCED DISCHARGES Ph.D. Thesis
Fred Albert Serravallo 1975 123 p
Avail. Univ. Microfilms Order No. 76-17220

The utilization of a reduced pressure microwave-induced helium plasma as a metal-selective gas chromatographic detector is described. Chromium beta-diketonates were detected by monitoring the 3578.7 A Cr(I) line, and selectivity ratios of 4000-7000 vs. benzene. Emission spectra of the chromium chelates in an oxygen-doped helium plasma are presented. The presence of trace amounts of oxygen is necessary to produce Cr(I) emission rather than molecular emission. Quenching of emission spectra by doping gases is also reported. These studies suggest that the excited states of helium and oxygen may be involved in the fragmentation and excitation mechanism in the helium plasma. The quenching properties of oxygen in microwave-induced discharges are shown to have important analytical implications for the microwave-induced emission spectrometric detector. Dissert. Abstr.

N76-30314 Cornell Univ., Ithaca, N.Y.
HIGH TEMPERATURE GAS PHASE KINETICS. 1: NITRIC OXIDE REDUCTION IN THE COMBUSTION OF HYDROCARBON MIXTURES. 2: LASER POWERED HOMOGENEOUS PYROLYSIS: DEVELOPMENT AND APPLICATIONS Ph.D. Thesis
Walter Michael Shaub 1976 166 p
Avail: Univ. Microfilms Order No. 76-18204

Mixtures of nitric oxide, oxygen and acetylene were shock heated to temperature from 1400 - 2600 K (reflected shock waves) in a single-pulse shock-tube. Reflected shock temperatures were estimated from measurement of incident shock velocities. Final product concentrations were measured utilizing gas chromatographic techniques. These data were reduced to concentration profiles of mole fraction of product versus reflected shock temperature, and of mole fraction of product versus fuel to oxidant or nitric oxide to oxygen ratios at fixed temperatures. The large absorption cross-section for infrared radiation possessed by sulfur hexafluoride, its relatively fast vibration-translation relaxation time and the availability of large laser fluxes at its characteristic frequency was effectively exploited to generate high bath temperatures for chemically homogeneous gas phase reactions. Dissert. Abstr.

N76-30315 Kansas Univ., Lawrence.
ANALYSIS FOR COPPER, IRON, AND CADMIUM IN PLANT MATERIALS BY ATOMIC ABSORPTION SPECTROSCOPY: A CRITICAL EVALUATION AND COMPARISON WITH ACCEPTED AOAC COLORIMETRIC METHODS Ph.D. Thesis
Duane Ray Boline 1975 100 p
Avail: Univ. Microfilms Order No. 76-17106

Atomic absorption spectroscopy for quantitative determination of copper, iron, and cadmium was investigated to determine trace metals in plant material. Ashed samples were diluted with methanol to achieve the increase in sensitivity needed for the analysis. Sensitivities of .07 ppm, .02 ppm, and .07 ppm were obtained for copper, iron, and cadmium respectively. Other ions known to be present in plants, including calcium, potassium, sodium, copper, cadmium, iron, sulfate, and phophate, were studied for possible interference effects. A comparison of results from the A.O.A.C. colorimetric methods and the atomic absorption procedure indicates that atomic absorption is as reliable and accurate as the A.O.A.C. accepted methods. Dissert. Abstr.

N76-30316 Michigan State Univ., East Lansing.
SPECTRAL ANALYSIS OF PHOSPHORUS CHEMILUMINESCENCE Ph.D. Thesis
Richard Jerry VanZee 1976 215 p
Avail: Univ. Microfilms Order No. 76-18684

The chemiluminescence of phosphorus oxidation under natural conditions is one of the oldest and best known chemiluminescing systems but one for which a definitive spectroscopic study has been lacking. Results are reported for the reaction of P4 vapor with air and added H2O or D2O vapor under normal atmospheric conditions. In addition, some results were obtained under high temperature conditions and some under low pressure conditions. The gas phase emission spectrum of phosphorus chemiluminescence under ambient conditions is found to consist of (1) a discrete emission system in the ultraviolet 228.8-272.1 nm region, (2) a discrete weak emission system in the 450-650 nm superimposed upon a continuum, (3) a continuum which extends from 335 nm into the near-infrared region, and (4) discrete band emission upon a continuum in the near-infrared region, from 0.7 to 1.2 microns. Dissert. Abstr.

N76-30317 New York State Univ., Albany.
THE MEASUREMENT OF DIFFUSION COEFFICIENTS BY THE GAS CHROMATOGRAPHIC BROADENING TECHNIQUE Ph.D. Thesis
Paul Nicholas Schnipelsky 1976 150 p
Avail: Univ. Microfilms Order No. 76-17054

The effects of isomerism on the binary diffusion coefficients of various alkanes has been studied. The isomers of hexane and heptane were used to illustrate these effects. Group diffusion volumes were calculated from the diffusion data. Their magnitude can be ascribed to the various shielding properties of the residual alkane molecule. Two methods for calculating Lennard-Jones parameters (sigma and epsilon) from diffusion data were developed. These methods were tested with the diffusion data compiled for the hexane isomers and n-alkane. The results correlate well with the expected configuration of the molecule and were obtained using the Gas Chromatographic Broadening method. A novel digital sequencer was constructed to control these experiments. The technique produced a precision in the diffusion data of less than 1%. Statistical moments were used to study the effects of solute molecular structure on peak shape. These moments and the associated retention times were used for the unambiguous qualitative characterization of various solutes.
Dissert. Abstr.

N76-30318 Stanford Univ., Calif.
EXPERIMENTAL STUDY OF NITRIC OXIDE-HYDROGEN REACTION KINETICS Ph.D. Thesis
William Lindsay Flower 1976 234 p
Avail: Univ. Microfilms Order No. 76-18765

The decomposition kinetics of nitric oxide at high temperatures were investigated. Mixtures of nitric oxide, molecular hydrogen, and inert gas (either argon or krypton) were heated by incident shock waves in a shock tube. The subsequent chemical reaction was monitored by using two high-speed infrared detectors to measure infrared emission from the 5.3-micron fundamental vibration-rotation band of NO and the 6.3 micron gamma sub 2 band of water vapor. Each detection system was calibrated to determine the response to NO and to H2O, which permits the calculation of NO and H2O concentrations from the measured emission records. The rate constant for the reaction NO + H yields N + OH which best fits the data from 21 shock-tube experiments was found to be k1 = 2.22 x 10 to the 14th power + or - 0.08 exp(-50.5/RT)cu cm/mole-sec in the temperature range 2400 - 4200 K. These data provide useful information for modeling the decomposition of NO at high temperature. Dissert. Abstr.

N76-30319*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NO sub X DESTRUCTION BY CO IN NO sub X TO NO CONVERTERS OF CHEMILUMINESCENT NO ANALYZERS
Robert L. Summers Jul. 1976 23 p refs
(NASA-TM-X-73480; E-8862) Avail: NTIS HC $3.50 CSCL 07D

An instrument modification for chemiluminescent NO - NOx analyzers was developed which minimizes the NOx destruction in the NOx to NO converters of NO analyzers due to high concentrations of CO. This mechanism causes the NO analyzers to indicate incorrect NOx concentrations when the analyzers are operated in the NOx analysis mode. The modification is applicable to analyzers in which the detection chamber is evacuated.
Author

N76-30320*# Rockwell International Science Center, Thousand Oaks, Calif.
INFRARED SPECTROSCOPIC MEASUREMENTS AND ANALYSIS Final Report, Jan. 1975 - Mar. 1976
George Birnbaum 5 Mar. 1976 24 p refs
(Contract NAS5-20820)
(NASA-CR-144793; SC5015.2FR) Avail: NTIS HC $3.50 CSCL 07D

The collision induced spectrum in equilibrium H2(eH2) and in equilibrium H2-He mixtures have been determined at densities below 120 amagat in the region 500 to 900 cm/1 at 293, 195, and 77K. The collision induced spectrum of normal H2 at 77K in the region 25 to 490 cm/1 has also been determined. The details of the experiment, experimental results, and comparison with previous results are presented. A report dealing with a new theory of the shape of pressure induced spectra with an application to the far infrared spectrum of eH2 at 77K is appended.
Author

N76-30321*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HETEROGENEOUS REACTION OF OZONE WITH ALUMINUM OXIDE
L. F. Keyser 15 Aug. 1976 39 p refs
(Contract NAS7-100)
(NASA-CR-148761; JPL-TM-33-782) Avail: NTIS HC $4.00 CSCL 07D

Rates and collision efficiencies for ozone decomposition on aluminum oxide surfaces were determined. Samples were characterized by BET surface area, X-ray diffraction, particle size, and chemical analysis. Collision efficiencies were found to be between 2 times 10 to the -10 power and 2 times 10 to the -9 power. This is many orders of magnitude below the value of 0.000001 to 0.00001 needed for appreciable long-term ozone loss in the stratosphere. An activation energy of 7.2 kcal/mole was found for the heterogeneous reaction between -40 C and 40 C. Effects of pore diffusion, outgassing and treatment of the aluminum oxide with several chemical species were also investigated.
Author

N76-30322# Ames Lab., Iowa.
BIBLIOGRAPHY OF MASS SPECTROSCOPY LITERATURE FOR 1972 COMPILED BY A COMPUTER METHOD. VOLUME 2: KEY WORD OUT OF CONTEXT (KWOC) INDEX
J. Capellen, comp., H. J. Svec, comp., C. R. Sage, comp., and R. Sun, comp. Aug. 1975 520 p refs
(Contract W-7405-eng-82)
(IS-3558-Vol-2) Avail: NTIS HC $13.75

This report covers the year 1972, and lists approximately 10,000 articles of interest to mass spectroscopists. This two-volume report consists of three sections. Vol. II contains the Key Word Out of Context Index (KWOC Index) section. The KWOC Index lists the key words, the reference numbers of the articles in which the key word appears, and the first 100 characters of the title.
Author (NSA)

N76-30323# Dornier-System G.m.b.H., Friedrichshafen (West Germany).
REACTION KINETICS AND TRANSPORT IN RELAXING GASES [REAKTIONSKINETIK UND TRANSPORT IN RELAXIERENDEN GASEN]
Klaus Baerwinkel and Helmut Wolters Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1975 137 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-WRT-2073; GfW-RV-11-V42/74)
(BMFT-FB-W-75-28) Avail: NTIS HC $6.00; ZLDI, Munich DM 28.80

Kinetic theory is applied in order to calculate the influence of internal excitations, chemical reactions, and nonequilibrium effects on rate constants and transport coefficients in gases. Dissociative reactions and three-body recombinations are taken into account by appropriately generalized Boltzmann equations. Reactive cross sections are physically modelled to fit experimental data. Explicit computations are restricted to binary mixtures of atoms and molecules of a single chemical element.Author (ESA)

N76-30324# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
EFFECT OF VIBRATION ENERGY ON THE REACTIVITY OF HCl MOLECULES IN PRESENCE OF H-, D-, O-, Cl-, AND Br-ATOMS [UNTERSUCHUNGEN ZUM EINFLUSS VON SCHWINGUNGSENERGIE AUF DIE REAKTIVITAET VON HCl-MOLEKUELEN IN GEGENWART VON H-, D-, O-, Cl- UND Br-ATOMEN]
Detlef Arnoldi Jul. 1975 75 p refs In GERMAN
(Rept-6/1975) Avail: NTIS HC $4.50

The exothermic reactions H, D + HCl(v = 1,2), the thermoneutral reaction O + HCl(v = 1,2), and the endothermic reaction Br + HCl(v = 1,2) were investigated using laser induced fluorescence. The construction of the equipment required for the measurements, HCl laser and flow reactor, is described. For the detection of the reaction products, the HCl laser was connected to a quadrupole mass spectrometer. The results of the measurements are presented and discussed.
ESA

N76-30325# Aeronutronic Ford Corp., Newport Beach, Calif.
VERSATILE GAS FILTER CORRELATION SPECTROMETER Final Report, Jun. 1973 - Jun. 1975
D. E. Burch, F. J. Gates, D. A. Gryvnak, and J. D. Pembrook Aug. 1975 75 p refs
(Contract EPA-68-02-1227)
(PB-251577/3; U-6201; EPA-600/2-75-024) Avail: NTIS HC $4.50 CSCL 14B

A versatile infrared analyzer employing gas filter correlation techniques has been designed and constructed to measure concentrations of pollutant gases from a variety of sources. By interchanging cell windows, radiant energy sources, gratings, interference filters, and detectors, nearly any desired spectral bandpass between 0.3 micrometers and 11 micrometers can be obtained. Spectral curves of transmittance can also be scanned. A multiple-pass sample cell provides sample paths between approximately 4 m and 40 m. An H2O monitor measures the concentration of H2O in the multiple-pass sample cell and automatically accounts for interference by H2O in the measurement of other gas concentrations. Tests have been performed on the measurement of formaldehyde, vinyl chloride and

ammonia. The minimum detectable concentration of formaldehyde in automotive exhaust is approximately 0.05 ppm. GRA

N76-30326# Pennsylvania State Univ., University Park. Applied Research Lab.

PROPAGATION OF A CHEMICAL REACTION THROUGH HETEROGENEOUS LITHIUM-POLYTETRA FLUOROETHYLENE MIXTURES Ph.D. Thesis

Richard B. Smith Dec. 1975 129 p refs

(Contract N00017-73-C-1418)

(AD-A021924; TM-75-302) Avail: NTIS CSCL 07/4

An analytical and experimental investigation of the propagation of a chemical reaction through heterogeneous lithium-polytetrafluoroethylene (PTFE) mixtures was conducted. PTFE in the form of both solid rod and resin was reacted with lithium, these reactants being initially at room temperature and under a vacuum. The reaction sample was of cylindrical geometry with the PTFE located along the longitudinal centerline. The chemical reaction was initiated at one end of the sample, and the motion of the propagating reaction front was monitored by means of thermocouples located at the lithium-PTFE interface. A two-dimensional model was developed based on the assumptions that the reaction rate controlling process was the thermal decomposition of the PTFE, that the reaction products were in the condensed phase, and that conduction was the sole mode of heat transfer. The dimensionless form of the model was solved numerically, and the predicted reaction propagation velocities were in reasonable agreement with experimental results. GRA

N76-30327# Naval Intelligence Support Center, Washington, D.C. Translation Div.

METHOD OF DETERMINING MICROQUANTITIES OF ORGANIC NITROGEN IN SEAWATER ESTABLISHED BY KROUGH AND KEYS

A. V. Simolin and T. Yu. Zelenin 16 Jan. 1976 8 p refs Transl. into ENGLISH from Akad. Nauk URSR (Kiev), v. 38, 1967 p 153-159

(AD-A021120; NISC-Trans-3746) Avail: NTIS CSCL 07/3

A method developed for determining organic nitrogen in sea water is described and applied to the Black Sea. Results are discussed. J.M.S.

N76-30328# Wisconsin Univ., Madison. Mathematics Research Center.

ACCESSIBLE DESIGNS IN SOLVAY CLUSTER SYNTHESIS

Dale F. Rudd Nov. 1975 14 p refs

(Contract DAAG29-75-C-0024)

(AD-A020219; MRC-TSR-1607) Avail: NTIS CSCL 07/4

Solvay clusters are sets of intermediate chemical reactions that execute a desired net reaction. It is shown that May-Rudd polygons give access to all Solvay clusters that involve two and three intermediate reactions regardless of the number of chemical species involved, and to all clusters that involve fewer than nine chemical species regardless of the number of chemical reactions. More elaborate Solvay clusters are accessible providing they exhibit a planar topological structure. GRA

N76-30329# Dow Chemical Co., Midland, Mich. Contract Projects Lab.

MECHANISM OF EXTINGUISHMENT OF JET FUEL FIRES Final Technical Report, 1 Dec. 1974 - 30 Nov. 1975

R. V. Petrella and H. R. Frick 1975 60 p refs

(Contract N00019-75-C-0172)

(AD-A022706) Avail: NTIS CSCL 13/12

This study is an attempt to examine the mechanisms by which halogenated hydrocarbons, such as trifluorobromomethane (CF3BR) and methyl bromide (CH3BR), function as fire extinguishments in a hydrocarbon combustion situation. The hydrocarbon fuels used in this study are n-pentane and cyclohexane. The technique of kinetic spectroscopy coupled to a spark ignition bomb is used to obtain combustion of the fuels in air or oxygen and to resolve the absorption spectra of the combustion intermediates as a function of time during the burning of the fuels. Combustion duration ranges from a few hundred microseconds (micrometer sec.) to several milliseconds (m sec.). The final products of combustion are determined by chromatographic separation. GRA

N76-30330# National Bureau of Standards, Washington, D.C. Center for Fire Research.

RADIATIVE IGNITION OF SOME TYPICAL FLOOR COVERING MATERIALS Final Report

Karen DenBraven Dec. 1975 22 p refs

(PB-251413/1; NBSIR-75-967) Avail: NTIS HC $3.50 CSCL 13L

The ignition time for some typical floor coverings was measured at varying incident radiant flux levels. A large radiant panel was used as a heat source, with a non impinging pilot flame 1.0 cm above the sample as an ignition source. Each material was subjected to a range of flux levels. Samples were 5 cm square, mounted horizontally below the radiant panel. A critical flux level, below which ignition did not occur, was determined for each material. GRA

N76-30331# National Bureau of Standards, Washington, D.C. Center for Fire Research.

SPACE HEATER INVOLVEMENTS IN FABRIC FIRES Final Report

Warren D. Hayes, Jr. Mar. 1976 25 p refs

(PB-251414/9; NBSIR-76-1014) Avail: NTIS HC $3.50 CSCL 13A

Eighty-two of the 1,573 direct fabric ignition incidents in FFACTS were caused by space heaters. Gas heaters were responsible for 83 percent of all direct garment ignitions where heater type was known. Nightgowns, dresses and robes account for 82 percent of all the garment items directly ignited. Forty-seven percent of the direct garment ignition incidents would probably not have occurred if the presently existing fabric flammability standards had been in effect at the time. GRA

N76-30332# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.

DETERMINATION OF GRAPHITE-LIQUID-VAPOR TRIPLE POINT BY LASER HEATING Interim Report

N. A. Gokcen, E. T. Chang, T. M. Poston, and D. J. Spencer 30 Jan. 1976 60 p refs

(Contract F04701-75-C-0076)

(AD-A021168; TR-0076(6270-10)-1; SAMSO-TR-76-29) Avail: NTIS CSCL 07/4

A technique was developed for measuring the melting temperatures of graphite, and the graphite-liquid-vapor triple point by means of continuous HF laser in the pressure range 120 to 215 atm. The triple point was found to be 120 + or - 10 atm and 4130 + or - 30 K for pyrolytic graphite. The results with neon, argon, and krypton as pressurization gases were concordant. A vapor-solid-liquid phase diagram was obtained in the vicinity of triple point. Photomicrography, electron micrography, X-ray diffraction, and ion microprobe mass analysis were used to characterize the structure of frozen liquid droplets, the pyrolytic graphite matrix, and condensed vapor. Author (GRA)

N76-30333# Argonne National Lab., Ill.

FINE DEFINITION OF IR SPECTRA FROM HIGH TEMPERATURE INTERACTIONS OF U PLUS O2, PART 2 Final Report, 1 Jul. 1974 - 30 Jun. 1975

D. W. Green, S. D. Gabelnick, and G. T. Reedy Aug. 1975 20 p refs

(DNA Proj. NWED-QAXHI002)

(AD-A020534; DNA-3744F-Pt-2) Avail: NTIS CSCL 07/4

The reactions of UO and UO2 with NO and NO2 have been studied by infrared (IR) spectroscopy using the matrix-isolation technique. Codeposition of vaporized UO and UO2 with NO2 and with NO gases in an argon matrix at 14K resulted in the production of the UO2(+) molecular ion with either a NO2(-) or NO(-) anion. IR absorption frequencies have been measured and interpreted as the stretching modes of a linear UO2(+) ion and a bent (bond angle = 109 degrees) NO2(-) ion. Three different reactions have been observed to yield a UO2(+) cation product: (1) UO2 + NO2; (2) UO2 + NO; and (3) UO + NO2. GRA

N76-30334# Illinois Univ., Urbana Dept. of Chemistry.

PROTON RELAXATION AND CHARGE ACCUMULATION DURING OXYGEN EVOLUTION IN PHOTOSYNTHESIS

T. Wydrzynski, N. Zumbulyadis, P. G. Schmidt, H. S. Gutowsky, and Govindjee 2 Jan. 1976 16 p refs

(Contract N00014-75-C-0163)
(AD-A020944; TR-9) Avail: NTIS CSCL 07/5

The water proton spin-spin (transverse) relaxation rate of chloroplast suspensions has been measured after each of a series of 2.4 microsec light flashes. The sequence of relaxation rates shows a damped oscillatory pattern with a period of four and peaks after the 3rd, 7th, 11th, and 15th flashes. This result indicates that water proton relaxation can be used to monitor the charge accumulating states as postulated by Kok and co-workers for the oxygen evolving mechanism in green plants ((1970) Photochem. Photobiol. 11, 457-475). GRA

N76-30335# Kentucky Univ., Lexington.
GAS ADSORPTION BY ACTIVATED AND IMPREGNATED CARBONS Quarterly Report, 9 Jul. - 8 Oct. 1975
P. J. Reucroft and C. T. Chiou Dec. 1975 30 p refs
(Contract DAAA15-74-C-0163; DA Proj. 1W7-62710-A-095)
(AD-A020488; EC-CR-76036; QR-6) Avail: NTIS CSCL 07/4

In the period reported, equilibrium adsorption isotherms have been measured for cyanogen chloride on BPL grade activated carbon, ASC whetlerite and three ASB impregnated carbons. The results have been analyzed in terms of the Dubinin-Polanyi isotherm equation. Adsorption components due to chemisorption and physical adsorption have been separated. Author (GRA)

N76-30336# Naval Surface Weapons Center, White Oak, Md.
PHOTOCHEMISTRY OF TNT: INVESTIGATION OF THE PINK WATER PROBLEM, PART 2 Final Report
L. A. Kaplan, N. F. Burlinson, and M. E. Sitzmann 21 Nov. 1975 46 p refs
(AD-A020072; NSWC/WOL/TR-75-152-Pt-2) Avail: NTIS CSCL 07/5

Irradiated aqueous solutions of TNT were found to contain numerous organic compounds. Thirteen photo decomposition products, amounting to approximately 40% by weight of the photolyzed TNT, have been identified. Suggestions are put forth on the nature of the remaining photo decomposition products unidentified. Evidence is also presented on the nature of the primary photolytic process based on deuterium exchange studies, measurements of the photo decomposition rate at various acidities, and experiments where the photochemical intermediate (TNT(-)) has been trapped. Author (GRA)

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N76-30337 Cornell Univ., Ithaca, N.Y.
GAS PHASE HYDROGEN PERMEATION THROUGH FERRITIC IRON, AUSTENITIC STAINLESS STEEL AND NEUTRON IRRADIATED AUSTENITIC STAINLESS STEEL FROM NEAR 300 K TO 873 K Ph.D. Thesis
Nathaniel Richard Quick 1976 178 p
Avail: Univ. Microfilms Order No. 76-18191

Hydrogen permeation through iron was studied over the temperature range 300-873 K by an ultra high vacuum, monopole gas analyzer technique. The permeation coefficient, with an activation enthalphy found to be 8.1 + or - 4. kcal/mole, was independent of both gas pressure and membrane thickness. At temperatures below approximately 600 K, the effective diffusivity increased with both increasing hydrogen gas pressure and increasing membrane thickness. The transition temperature from classical to anomalous behavior decreases with increasing thickness. A positron annihilation study showed dislocations to be the most probable, dominant trap species. In contrast, hydrogen permeation through type 310 austenitic stainless steel, studied over the temperature range 425-873 K, showed no volume trapping effects. Finally, the hydrogen-deuterium isotopic effect was shown to be non-classical in iron while classical in stainless steel. Dissert. Abstr.

N76-30338 Washington Univ., Seattle.
SURFACE COMPOSITION AND WORK FUNCTION OF SILVER-GOLD AND COPPER-GOLD ALLOYS Ph.D. Thesis
James Michael McDavid 1975 116 p
Avail: Univ. Microfilms Order No. 76-17559

Experimental results are presented for in situ Auger and work function measurements on clean evaporated Ag-Au and Cu-Au films having (111)-orientation. Auger signals used for analysis were normalized to pure metal references evaporated simultaneously with the alloy. An electron beam retarding potential method using the electron gun of the Auger Spectrometer was used to determine the difference in work function between an alloy and a Au reference. The known energy dependence of the electron attenuation length was used to interpret the Auger data. For Cu-Au alloys the normalized signals from 72 eV, 239 eV, and 2024 eV transitions from Au were converted to atomic layer compositions in a model which allowed the first two atomic layers to differ in composition from the bulk. A large amount of enrichment of the first layer with Au was found over the entire range of composition studied. Dissert. Abstr.

N76-30339 Maryland Univ., College Park.
EFFECTS OF GRAIN SIZE AND TEMPERATURE ON QUASI-BRITTLE FRACTURE IN A533 B STEEL Ph.D. Thesis
Fred Russell Stonesifer 1975 89 p
Avail: Univ. Microfilms Order No. 76-18842

A medium strength pressure vessel steel, A533 B, was tested in three widely varying prior austenitic grain sizes at four temperatures within its essentially brittle fracture range. The results show the effects of both austenite grain size and temperature on quasi-brittle fracture. The data are shown to relate to several theories, as well as some newly proposed ideas, dealing with the quasi-brittle fracture process. Grain size and temperature affect sub-critical crack growth rate in A533 B steel only to the extent to which they affect K sub Ic and the onset of rapid fracture. The zero growth threshold seems virtually unaffected by either grain size or temperature within the brittle fracture range. Dissert. Abstr.

N76-30340 Maryland Univ., College Park.
STRESS-GRAIN SIZE ANALYSIS OF THE YIELD AND FRACTURE BEHAVIOR OF STEEL AND TITANIUM AT 4.2 DEG K Ph.D. Thesis
Narayan Murali Madhava 1975 157 p
Avail: Univ. Microfilms Order No. 76-18828

The deformation and fracture behavior of polycrystalline steel and titanium materials at cryogenic temperatures have been studied in order to provide an understanding of their potential brittleness. SAE 1010 steel, Marz grade zone refined titanium, and commercial grade A-70 titanium materials were tested over a wide range of grain sizes, under tension and compression, at the two strain rates of 0.00013 and 0.013/sec, and at 4.2 K, 77 K, and 300 K. Observation of the deformation structures was accomplished by metallographic and fractographic techniques. At 4.2 K the steel material underwent brittle fracture in tension while titanium materials always exhibited essentially ductile fractures with considerable plastic strain preceding the fracture event. These results appear explainable at one level in that the occurrence of a ductile-brittle transition, say, as observed for steel, may simply depend on whether or not cleavage crack propagation can be forced to occur. Dissert. Abstr.

N76-30341 Michigan State Univ., East Lansing.
EFFECT OF TEMPERATURE ON THE DEFORMATION BEHAVIOR OF TWO-PHASE BICRYSTALS OF ALPHA-BETA BRASS Ph.D. Thesis
Ali-Asghar Khezi-Yazdan 1976 177 p
Avail: Univ. Microfilms Order No. 76-18639

Two-phase bicrystals of alpha-beta brass were deformed at various temperatures to investigate the effect of ordering and disordering in beta brass on the overall deformation behavior of this two-phase alloy. Tensile testing of these specimens was carried out at various strain-rates at 700, 800, 900 and 1,000 F to gain understanding of the basic mechanisms involved. Single crystals of alpha and beta brass, as well as coarse-grained beta brass, were also deformed at these temperatures at various strain-rates. The deformation structures were studied by optical microscopy. Deformation of beta, unlike alpha, was found to be highly sensitive to temperature and strain-rate. The predominant mode of deformation in beta at temperatures below T sub c (ordering temperature) was by grain boundary sliding, and at

temperatures above T sub c it was by slip. Further, beta did not exhibit any work-hardening at temperatures above T sub c.
Dissert. Abstr.

N76-30342 Pennsylvania State Univ., University Park.
TRANSMISSION ELECTRON MICROSCOPE INVESTIGATION OF LATTICE AND GRAIN BOUNDARY DISLOCATIONS Ph.D. Thesis
Ramakrishna Taranath Bhatt 1975 165 p
Avail: Univ. Microfilms Order No. 76-17145

The dislocations present in type 347 stainless steel were studied to develop suitable techniques for the identification of dislocation Burgers vectors and then apply said techniques to both lattice and grain boundary dislocations. Two techniques were utilized: dark field contrast minima and computer simulation. A refinement of the computer program was developed, and the Adage capability of the Penn State computer system was programmed and utilized to better display the computed dislocation images. The combination of dark field contrast and computer simulation was found to be adequate for a systematic study of lattice dislocations aimed at characterizing them according to their Burgers vectors. Dissert. Abstr.

N76-30343 Michigan State Univ., East Lansing.
COMPUTER-ASSISTED EXPERIMENTAL AND ANALYTICAL STUDY OF TIME/TEMPERATURE-DEPENDENT THERMAL PROPERTIES OF THE ALUMINUM ALLOY 2024-T351 Ph.D. Thesis
Khosrow Farnia 1976 198 p
Avail: Univ. Microfilms Order No. 76-18616

A transient thermal properties measurement facility was developed to study the thermal property changes of as received aluminum alloy 2024-T351 under the influence of isothermal precipitation hardening. The developed transient measurement facility utilized the IBM 1800 computer for both the acquisition of transient temperature measurements and the analysis of this data. The transient thermal properties measurement technique was tested using Armco iron, as received Al-2024-T351 with no precipitation (fast measurement cycles), and the annealed Al-2024-T351 materials. The results of experiments are presented in both tabulated and equation form. The functional relations were found using the least-squares technique. Dissert. Abstr.

N76-30344*# Case Western Reserve Univ., Cleveland, Ohio.
THE USE OF THE ION PROBE MASS SPECTROMETER IN THE MEASUREMENT OF HYDROGEN CONCENTRATION GRADIENTS IN MONEL K 500 Summary Report, Apr. 1973 - Oct. 1974
J. J. Truhan, Jr. and R. F. Hehemann Oct. 1974 55 p refs
(Grant NGR-36-027-051)
(NASA-CR-134711) Avail: NTIS HC $4.50 CSCL 11F

The ion probe mass spectrometer was used to measure hydrogen concentration gradients in cathodically charged Monel K 500. Initial work with the ion probe involved the calibration of the instrument and the establishment of a suitable experimental procedure for this application. Samples of Monel K 500 were cathodically charged in a weak sulfuric acid solution. By varying the current density, different levels of hydrogen were introduced into the samples. Hydrogen concentration gradients were taken by ion sputtering on the surface of these samples and monitoring the behavior of the hydrogen mass peak as a function of time. An attempt was made to determine the relative amounts of hydrogen in the bulk and grain boundaries by analyzing a fresh fracture surface with a higher proportion of grain boundary area. It was found that substantially more hydrogen was detected in the grain boundaries than in the bulk, confirming the predictions of previous workers. A sputter rate determination was made in order to establish the rate of erosion. Author

N76-30345*# Cornell Univ., Ithaca, N.Y.
PHASE SEPARATION OF METALLIC HYDROGEN-HELIUM ALLOYS
David M. Straus, N. W. Ashcroft, and H. Beck, (Basel Univ., Switzerland) Jun. 1976 44 p refs
(Grant NGR-33-010-188)
(NASA-CR-148578) Avail: NTIS HC $4.00 CSCL 11F

Calculations are presented for the thermodynamic functions and phase separation boundaries of solid metallic hydrogen helium alloys at temperatures between 0 K and 19,000 K and at pressures between 15 and 90 megabars. Expressions for the band structure energy of a randomly disordered alloy (including third order in the electron ion interaction) are derived and evaluated. Short and long range order are included by the quasi-chemical method, and lattice dynamics in the virtual crystal harmonic approximation. We conclude that at temperatures below 4,000 K there is complete phase separation of hydrogen helium alloys, and that a miscibility gap remains at the highest temperatures and pressures considered. The relevance of these results to models of the deep interior of Jupiter is briefly discussed. Author

N76-30346*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LOW VAPOR PRESSURE BRAZE ALLOYS FOR THERMIONIC ENERGY CONVERTERS
Virginia L. Bair 1976 11 p refs Presented at the Intern. Conf. on Plasma Science, Austin, Texas, 24-26 May 1976; sponsored by IEEE
(NASA-TM-X-73493; E-8891) Avail: NTIS HC $3.50 CSCL 11F

The evaluation of cesium diode electrode materials called for braze fillers with very low vapor pressures and a wide range of melting points. Binary alloys of low vapor pressure refractory metals were chosen to fill this need. These alloys of Th, Zr, Hf, Ru, Nb, Ir, Mo, Ta, Os, Re, and W have reported melting point minima or eutectics from 1,510 K to above 3,000 K. Preliminary data are compiled on the use of several of these braze alloys. Melting points and surface wetting on a Ta base are given. Results of brazing Ir, LaB6, Nb, Re, W, and Zr-22 wt % ZrO2 materials into Ta and Nb-1% Zr bases are presented. Current braze usage is summarized. Author

N76-30347*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VOLUME FRACTION DETERMINATION IN CAST SUPERALLOYS AND DS EUTECTIC ALLOYS BY A NEW PRACTICE FOR MANUAL POINT COUNTING
C. W. Andrews Jun. 1976 25 p refs
(NASA-TM-X-73449; E-8787) Avail: NTIS HC $3.50 CSCL 11F

Volume fraction of a constituent or phase was estimated in six specimens of conventional and DS-eutectic superalloys, using ASTM E562-76, a new standard recommended practice for determining volume fraction by systematic manual point count. Volume fractions determined ranged from 0.086 to 0.36, and with one exception, the 95 percent relative confidence limits were approximately 10 percent of the determined volume fractions. Since the confidence-limit goal of 10 percent, which had been arbitrarily chosen previously, was achieved in all but one case, this application of the new practice was considered successful. Author

N76-30348*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MICROSTRUCTURAL CHANGES CAUSED BY THERMAL TREATMENT AND THEIR EFFECTS ON MECHANICAL PROPERTIES OF A GAMMA/GAMMA PRIME - DELTA EUTECTIC ALLOY
Surendra N. Tewari and Robert L. Dreshfield Washington Aug. 1976 36 p refs
(NASA-TN-D-8280; E-8531) Avail: NTIS HC $4.00 CSCL 11F

Microstructural changes due to thermal treatments of a directionally solidified gamma/gamma'-delta eutectic alloy were investigated. Aging treatments of 8 to 48 hours and ranging from 750 to 1120 C were given to the alloy in both its as directionally solidified condition and after gamma' solutioning. Aging resulted in gamma' coarsening, gamma precipitates in delta, and delta and gamma'' precipitates in gamma. The tensile strength was increased about 12 percent at temperatures up to 900 C by a heat treatment. Times to rupture were essentially the same or greater than for as directionally solidified material. Tensile and rupture ductility in the growth direction of the alloy were reduced by the heat treatment. Author

N76-30349# Naval Ordnance Station, Louisville, Ky.
EXPLOSIVE FORMING HIGH STRENGTH STEEL HY-130)

LARGE HEMISPHERICAL HEADS Final Report, Jun. 1970 - Jun. 1974
Richard P. Grollo Apr. 1975 250 p
(SF51541018)
(AD-A022127; NOSL-MT-033) Avail: NTIS CSCL 13/8

This report describes a program to explosively form large high strength steel (HY-130) hemispherical heads from welded preforms. Since the finished product ranged from 20 to 50 feet in diameter, subscale preform models were used to determine the parameters necessary to form the larger sized heads. Early in the program it was determined that the greatest problem area lies in weld seam formability. Additional investigation was proposed and funded to conduct testing along these lines; two subscale hemi-head preforms were manufactured and explosively formed. The weld seam failures precluded continuance along the welded preform concept. Also reported is the in-depth study of pre- and post-forming properties of the HY-130 steel alloy.
Author (GRA)

N76-30350# California Univ., Berkeley. Lawrence Berkeley Lab.
CREEP RUPTURE PROPERTIES OF LAVES PHASE STRENGTHENED Fe-Ta-Cr-W AND Fe-Ta-Cr-Wo ALLOYS M.S. Thesis
S. Singh Dec. 1975 57 p refs Sponsored by ERDA
(LBL-4504) Avail: NTIS HC $4.50

A small addition of tungsten (0.5 at. percent) was shown to have an effect similar to that of molybdenum on the phase transformation characteristics of alloy Ta7Cr (with a nominal composition of 1 at. percent Ta, 7 at. percent Cr, balance Fe). The existence of time-temperature dependent transformation behavior in alloy Ta7Cr0.5W was confirmed. The effect of spheroidization time and temperature on creep strength was determined. In addition, effect of mechanical processing, prior to aging, on creep strength was also determined. It was also shown that by suitable modifications of composition, the grain boundary film can be broken during the aging treatment without the use of spheroidization treatment. Microhardness, tensile and creep properties have been determined. Optical metallography and scanning electron microscopy have been used to follow the microstructural changes and mode of fracture. The creep rupture strength of alloy Ta7CrW alloy was found to be superior to many of the best commercially available ferritic alloys at 1,200 F.
Author (NSA)

N76-30351# Los Alamos Scientific Lab., N.Mex.
DUCTILE TO BRITTLE TRANSITION OF U-0.75 WT PERCENT Ti PENETRATOR CORES
T. I. Jones and D. J. Sandstrom Aug. 1975 10 p Sponsored in part by Air Force Armament Lab., Eglin AFB, Fla.
(Contract W-7405-eng-36)
(LA-6064-MS) Avail: NTIS HC $4.00

V-notch Charpy impact specimens were machined from U-0.75 wt percent Ti penetrator cores supplied by the Air Force Armament Laboratory. The response of these specimens to impact loads at various temperatures was measured. The data indicated that the impact energy required to cause fracture was a function of temperature and appeared to be insensitive to microstructural and hardness variations. All tests from - 54 to 300 C indicated a brittle condition with data fitting the impact energy equals 4.41e/sup 0.0048t/ equation.
Author (NSA)

N76-30352# Hanford Engineering Development Lab., Richland, Wash.
EFFECT OF SILICON ON MICROSTRUCTURE OF NEUTRON IRRADIATED TYPE 316 STAINLESS STEEL
H. R. Brager May 1974 21 p Presented at the Symp. on The Effects of Radiation on Structural Mater., Gatlinburg, Tenn., 11 Jun. 1974
(Contract E(45-1)-2170)
(HEDL-SA-655; Conf-740651-8) Avail: NTIS HC $3.50

Solution-treated AISI 316 SS containing 0, 05, 1, 1.5, and 2 wt percent SI was irradiated in EBR-II to low fluences of 2 to 4 x 10 to the 22nd power and examined by transmission electron microscopy. Results are: The absence of Si (less than 0.01 percent) greatly decreases the swelling resistance by enhancing void nucleation. At 405 C, increasing the Si content decreases swelling by inhibiting void nucleation, while at 610 C, a complex relation exists between swelling and Si content due to heterogeneous void formation and its association with second-phrase precipitates.
NSA

N76-30353# Hanford Engineering Development Lab., Richland, Wash.
INFRARED ELECTRO-THERMAL NDE OF STAINLESS STEEL
D. R. Green and J. A. Hassberger 18 Jul. 1975 28 p ref Presented at conf. of Am. Soc. for Nondestructive Testing, Inc., Atlanta, 13 Oct. 1975
(Contract E(45-1)-2170)
(HEDL-SA-1004A; Conf-751016-5) Avail: NTIS HC $4.00

Electro-thermal examination, a branch of thermal testing, is a promising method being developed for nondestructive examination of stainless steel welds. This paper describes the first phase of development; i.e., preliminary demonstration and laboratory evaluation of the method's sensitivity to notches in Type 304 stainless steel plate specimens. It also includes a description of the basic principles, together with a description of the hardware and experimental results showing that electrical discharge machined notches down to 0.16 cm long x 0.08 cm deep were detected. A qualitative technique for interpreting the test results to determine whether defects are at the surface or deeper within the material is demonstrated.
Author (NSA)

N76-30354# Oxford Univ. (England). Dept. of Engineering Science.
THE INFLUENCE OF STRAIN-RATE HISTORY ON THE SHEAR STRENGTH OF COPPER AND TITANIUM AT LARGE STRAINS
A. M. Eleiche and J. D. Campbell Oct. 1974 61 p refs
(OUEL-1106/74) Avail: NTIS HC $4.50

Incremental strain rate change tests were performed using a modified torsional split Hopkinson bar in which a high shear strain rate is suddenly imposed on a short specimen while it is being plastically deformed at a much lower rate. The length of the loading bar system provides a useful torsional pulse of 1 ms duration which enables specimen shear strain up to 1.0 to be achieved at a strain rate of 1,000/s. Provision is also made for testing at temperatures up to 500 C. On this apparatus OFHC copper was tested at temperatures of 24, 200, and 400 C. Specimens were twisted at an average shear strain rate of 0.003/s, and the rate was suddenly increased to 900/s at predetermined values of the static shear strain, nominally 0.10, 0.25, and 0.50. The subsequent dynamic behavior was recorded and compared with that of similar specimens deformed at an average strain rate of 900/s without pre-straining. Similar tests have also been performed at room temperature on commercially pure titanium.
Author (ESA)

N76-30355# European Space Agency, Paris (France).
DEFORMATION AT HIGH TEMPERATURE OF COPPER-SILICA DISPERSION-STRENGTHENED ALLOYS
Rene Ramboarina Apr. 1976 67 p refs Transl. into ENGLISH of "Deformation a Haute Temp. des Alliages a Phase Dispersee Cuivre-Silice", ONERA, Paris Report ONERA-NT-224, 1974
(ESA-TT-277; ONERA-NT-224) Avail: NTIS HC $4.50

Copper single crystals containing a volume fraction of silica were prepared by internal oxidation at 700 C of copper silicon single crystals (fractions f = 0.4, 0.8, and 4%). Creep of these single crystals was studied at temperatures above 500 C. When creep arises in tension, premature reduction of area is found in the test piece, which makes the results difficult to apply. Hence, most of the tests were carried out under compression. The activation parameters of steady-state creep were measured. The activation energy was found to be equal to the self-diffusion energy of copper in the range studied. The exponent characterizing the effect of stress on the steady-state creep rate is 2 to 5, depending on the composition and temperature. The single crystals exhibit a behavior more similar to that of pure copper than to that of other dispersion-strengthened alloys (Al-Al2O3 or Ni-ThO2).
Author (ESA)

N76-30356# Naval Ship Research and Development Center, Bethesda, Md.
ANALYSIS OF GALVANIC CORROSION BETWEEN A TITANIUM CONDENSER AND A COPPER-NICKEL PIPING SYSTEM

Harvey P. Hack and Wayne L. Adamson Jan. 1976 27 p refs
(AD-A020476; DTNSRDC-4553) Avail: NTIS CSCL 13/8

Tests were conducted in a specially designed seawater-corrosion test loop to evaluate the extent of galvanic corrosion expected from the installation of an all-titanium steam condenser in a shipboard 70-30 copper-nickel piping system. Titanium to copper-nickel area ratios of 1:1, 2:1, and 100:1 were used in the loop. Copper-nickel specimens were exposed to seawater at a velocity of 10 feet per second and temperatures between 75 and 110 F (24 to 43 C). Corrosion rates for uncoupled copper-nickel specimens increased from 0.5 to 2.2 mils per year (0.01 to 0.06 millimeter per year) to 5.1 to 23.5 mils per year (0.13 to 0.60 millimeter per year) upon coupling to a simulated titanium condenser. Results showed that a change in the area ratio from 1:1 to 100:1 only doubled the corrosion rate of the copper-nickel specimens. No significant difference in corrosion rate was found between seawater inlet and outlet ends of the condenser. Complete corrosion protection was established by the use of sacrificial zinc or impressed-current cathodic-protection systems. GRA

N76-30357# Frankford Arsenal, Philadelphia, Pa.
ELIMINATION OF OIL IN QUENCH HARDENING OF PROJECTILE BODIES Final Report
Duane O. Gustad Nov. 1975 41 p
(DA Proj. 5734114)
(AD-A021187; FA-TR-75080) Avail: NTIS CSCL 13/8

A synthetic water based quenchant was successfully used in heat treatment of 155mm M107 projectiles. Approximately 6,000 projectiles were heat treated using Houghton 251 quenchant and a production heat treating furnace. Mechanical property, magnetic particle and ballistic test results on the heat treated projectiles are reported along with toxicity and biodegradability test results performed on the quenchant. The flame, smoke and fire hazard associated with oil quenching of projectiles was eliminated using the water based quenchant. GRA

N76-30358# REM Metals Corp., Albany, Oreg.
INVESTMENT CASTING OF COLUMBIUM ALLOYS Final Report, 26 Aug. 1974 - 26 Jul. 1975
J. R. Humphrey and Abraham I. Niravath Oct. 1975 146 p
(Contract DAAG46-75-C-0007)
(AD-A020599; AMMRC-CTR-75-25) Avail: NTIS CSCL 13/8

The state of the art of columbium alloy investment castings has been advanced. In addition to demonstration of castability of four different alloys, the cast material itself has been characterized with respect to microstructure, alloy segregation, weldability, and the effect of heat treatment. Based upon a number of alloy selection criteria, one of the alloys, C-103, was chosen for more detailed investigation including casting of solid and cored turbine vanes having a wall thickness as low as 0.040 in. Heat treatment parameters were established for optimization of C-103 mechanical properties including post-weld heat treatment. Under some casting conditions, the as-cast mechanical properties are equivalent to wrought properties. Heat treatment improves particularly ductility, and restores properties after welding. Chemistry, mechanical property, and economic considerations of material recycle are discussed. A tentative specification has been written covering C-103 castings incorporating producibility and material characterization available to date. GRA

N76-30359# California Univ., Los Angeles. Dept. of Materials.
A STUDY OF STRAIN HARDENING AND FRACTURE IN IRON-BASED ALLOYS Final Report, 1 Sep. 1968 - 31 Aug. 1975
Alan S. Tetelman Feb. 1976 17 p
(Contract DAHC04-69-C-0008)
(AD-A022386; UCLA-ENG-7621; ARO-8016.14-MC) Avail: NTIS CSCL 11/6

This final report summarizes the results of 16 papers from separate investigations into various aspects of Macroscopic and Microscopic Fracture behavior of steel. Particular attention of paid to understanding the relationship between macroscopic and microscopic aspects of fracture, the development of inexpensive fracture testing techniques, and an understanding of the metallurgical parameters that control fracture behavior. Author (GRA)

N76-30360# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.
CONTRIBUTIONS TO THE DATA ON THEORETICAL METALLURGY. 16: THERMODYNAMIC PROPERTIES OF NICKEL AND ITS INORGANIC COMPOUNDS Final Report
Alla D. Mah and L. B. Pankratz Mar. 1976 131 p refs
(PB-252194/6; BM-B-668) Avail: NTIS HC $6.00 CSCL 07B

Thermodynamic data on nickel and its compounds were critically reviewed, evaluated, and compiled. Values of the properties, heat capacity, entropy, relative enthalpy, Gibbs energy function, enthalpy of formation, Gibbs energy of formation, and logarithm of the equilibrium constant, are presented in tabular format. Heat capacity, relative entropy, relative enthalpy of formation, and Gibbs energy of formation are also expressed algebraically. Values of enthalpy of formation, Gibbs energy of formation and logarithm of the equilibrium constant are tabulated for selected reactions involving nickel compounds with emphasis on reactions of pf metallurgical interest. GRA

N76-30361# Effects Technology, Inc., Santa Barbara, Calif.
FRACTURE TOUGHNESS DATA FOR FERRITIC NUCLEAR PRESSURE VESSEL MATERIALS. TASK B: LABORATORY TESTING Final Report
W. L. Server, J. W. Sheckherd, and R. A. Wullaert Apr. 1976 320 p refs Sponsored by Elec. Power Res. Inst., Palo Alto, Calif.
(PB-252210/0; EPRI/NP-119; EPRI-RP232-1-F) Avail: NTIS HC $9.75 CSCL 11F

A comprehensive testing program on production heats of ferritic nuclear pressure vessel steel has recently been completed, and the results from this program are documented in this report. Mechanical tests performed include tensile, drop weight NDTT, Charpy V-notch, instrumented precracked Charpy, static and dynamic compact fracture and dynamic three-point bend. Fracture mechanics tests were performed on specimens up to four inches thick. Also presented are the complete history for each heat of material, i.e., mill test reports and welding history, metallography, chemistry, archive lists, and specimen cutting diagrams. GRA

N76-30362# Battelle Columbus Labs., Ohio.
CENTRIFUGALLY CAST STAINLESS STEEL FIBER-REINFORCED REFRACTORY PIPE Final Report, 1 Jun. - 29 Dec. 1975
Charles W. Kistler, David R. Lankard, and J. Richard Schorr 29 Dec. 1975 48 p refs
(Contract DI-BM-HO-252064)
(PB-252292/8; BM-OFR-60-76) Avail: NTIS HC $4.00 CSCL 11D

This research was initiated to develop a self-supporting ceramic pipe for use in coal gasification systems. Ideally, the pipe would be impermeable and strong enough to replace steel pipe that is susceptible to corrosion by acidic species in the product gas. However, a more reasonable objective would be a preformed ceramic pipe that could be used as a liner inside the steel pressurized shell, but the liner must have properties superior to those of castable refractories now used for this application. This program demonstrated that 3-inch ID pipes can be fabricated from a stainless-steel-fiber-reinforced refractory castable mix by centrifugal casting. Although it is possible to obtain some degree of preferential fiber orientation by introducing the fibers and castable separately, this procedure is complicated in that (1) multiple batches of fibers must be weighed out for each pipe; (2) alternative additions of fibers and castable are time consuming, requiring almost twice the fabrication time needed with a preblended mix; and (3) fiber feed rates are hard to control. GRA

N76-30363# Rockwell International Science Center, Thousand Oaks, Calif.
DEFORMATION AND DECOMPOSITION OF METASTABLE bcc TITANIUM ALLOYS Final Report, 1 Jun. 1971 - 31 Dec. 1975

C. G. Rhodes and N. E. Paton 27 Feb. 1976 61 p refs
(Contract N00014-71-C-0363; NR Proj. 031-752)
(AD-A022443; SC518.36FR) Avail: NTIS CSCL 11/6

The effect of microstructure on mechanical properties of metastable beta titanium alloys was investigated, with emphasis on the influence of alpha-phase precipitation on tensile strength and ductility. A commercial alloy, Ti-3Al-8V-6Cr-4Mo-4Zr (Beta-C) has been aged to produce both Type 1 alpha (obeying the Burgers orientation relation) and 2 alpha (not obeying the Burgers relation) as hardening precipitates in the beta matrix. Although a direct comparison of Types 1 and 2 alpha could not be made, there did not seem to be any direct correlation between precipitate type and mechanical properties. Rather, it has been found that overaging to produce a coarse distribution of relatively large (= 1000 A) noncoherent alpha precipitates provides the best combination of strength and ductility. The same strength can be achieved with much finer distribution of small (approximately 100-200 A) coherent alpha precipitates, but with much reduced ductility. GRA

N76-30364# Dayton Univ. Research Inst., Ohio.
TEMPERATURE EFFECT ON THE MECHANICAL PROPERTIES OF ALUMINUM ALLOY 2124-T851 Final Technical Report, Mar. 1974 - Sep. 1975
Russell R. Cervay Wright-Patterson AFB, Ohio AFML Dec. 1975 30 p refs
(Contract F33615-74-C-5024; AF Proj. 7381)
(AD-A021689; AFML-TR-75-208) Avail: NTIS CSCL 11/6

The test material, aluminum alloy/temper 2124-T851, was a 2.5 inch (63.5 mm) thick plate. Variation in the test material's strength, toughness and cyclic loading crack growth rate were examined as influenced by test temperature or furnace exposure temperature. GRA

N76-30365# American Univ., Washington, D.C. Dept. of Chemistry.
MECHANISM OF PIT INITIATION ON ALUMINUM ALLOY TYPE 7075 Technical Progress Report
Steven Dallek and R. T. Foley Feb. 1976 31 p refs
(Contract N00014-75-C-0799; NR Proj. 036-106)
(AD-A021695; TR-3) Avail: NTIS CSCL 11/6

The influence of anions on the initiation of pitting and the kinetics of pit growth on aluminum alloy type 7075 has been investigated. The order of reaction (i.e. the number of anions per Al surface reaction site) and the energy of activation for pitting initiation has been measured in f(-), Cl(-), Br(-) and i(-) solutions. The technique involved potentiostating the alloy in the range of anodic passivity, injecting a solution of halide ion, and recording the time, Tau, at which an exponential increase in corrosion current occurs. The slope of the plot of the logarithm pf 1/Tau versus the logarithm of the concentration gives, 'n', the number of anions associated with an Al surface reaction site in the primary pitting initiation step. The value of 'n' in 1 NH2SO4 varies with the anion, as, for Cl(-) nd 0.46 kcal/mole for f(-). These results are interpreted in terms of the formation of transitory species akin to activated complexes, of specific composition, such as AlBr(-)4. Author (GRA)

N76-30366# California Univ., Los Angeles. Dept. of Materials.
ON THE MINIMIZATION OF STRAIN ENERGY IN MARTENSITIC TRANSFORMATION OF TITANIUM
M. Shibata and Kanji Ono Dec. 1975 46 p refs
(Contract N00014-75-C-0889; NR Proj. 031-781)
(AD-A022429; TR-1) Avail: NTIS CSCL 11/6

A new theory of martensitic transformation based on the minimization of total strain energy has been developed, as an extension of one developed by Eshelby. The plastic relaxation strain (PRS) concept is introduced in order to relieve the high internal stress due to martensitic transformation. It is postulated that the minimization of elastic strain energy and the plastic work from the operation of a PRS system dictates the morphology and orientation of a transformation product and the amount and type of the PRS. The theory was applied to the case of martensitic transformation in Ti. GRA

N76-30367# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Metallurgy and Materials Science.
EFFECT OF DISSOLVED HYDROGEN ON MECHANICAL BEHAVIOR OF METALS
I. M. Bernstein, R. Garber, and G. M. Pressouyre Feb. 1976 35 p refs
(Contract N00014-75-C-0265)
(AD-A022276; CMU-036-099-4; TR-5) Avail: NTIS CSCL 11/6

The effect of internal, or dissolved hydrogen on mechanical behavior of metals is reviewed. If a supersaturation is produced, internal cracks or blisters result. The extent and nature of cracking are shown to be related to both composition and heat treatment. Effects of hydrogen on brittle and ductile fracture are discussed. The occurrence of these phenomena depends on the intrinsic crack resistance of the lattice and of interfaces, the noxious and innocuous interaction of hydrogen with traps, such as particles and clusters, and the relative mobility of dissolved hydrogen. While each of these are amenable to control, this cannot be successfully achieved without a careful characterization of the interaction between internal hydrogen and metallurgical variables. Author (GRA)

N76-30368# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.
COMPATIBILITY OF ALLOYS WITH HYDRAZINE CONTAINING FREON
E. T. Chang and N. A. Gokcen 20 Feb. 1976 29 p refs
(Contract F04701-75-C-0076)
(AD-A022434; SAMSO-TR-76-34; TR-0076(6270-10)-2) Avail: NTIS CSCL 11/6

The compatibility of hydrazine containing various amounts of Freon 13B1 and Freon TF with 304L and 308 stainless steels that had been joined with Au-Ni braze and Cu braze was investigated in detail. The results are presented in various tables and graphs. It has been found that 304L stainless steel and Au-Ni braze are the most compatible of the combinations of materials, and Freon TF is a more deleterious contaminant in hydrazine than Freon 13B1. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N76-30369 Iowa State Univ. of Science and Technology, Ames.
ELECTRICAL SWITCHING IN BULK SAMPLES OF 0.15As-0.12Ge-0.73Te GLASS Ph.D. Thesis
David E. Eckels 1976 104 p
Avail: Univ. Microfilms Order No. 76-18274

Electrical switching which occurs as a result of the thermal mechanism was studied. Switching in bulk samples of 0.15As-0.12Ge-0.73Te glass was verified to be caused predominantly by the thermal switching mechanism for near threshold applied voltages. Also, switching in this bulk sample of glass occurred by the thermal mechanism even for applied voltages an order of magnitude above the threshold voltage of the sample. A constant voltage pulse was applied to the sample and the delay time and the electrical energy input to the sample during the delay time were measured. A log-log plot of the energy input to the sample during a delay time of 1.00 s as a function of the electrode spacing on the sample's surface was found to have a slope of approximately 1.6. For the theoretical study of the thermal switching mechanism, a one dimensional calculation of the heat balance equation with radial heat flow was made. Dissert. Abstr.

N76-30370 Ohio Univ., Athens.
CONTINUOUS EXTRUSION AND ORIENTATION OF TRANSPARENT POLYETHYLENE FIBER Ph.D. Thesis
Thomas Yiu Tai Tam 1975 123 p
Avail: Univ. Microfilms Order No. 76-18454

The objectives in these studies are twofold: first, to prove that the primary condition necessary for producing a transparent and highly oriented fiber is crystallization during flow orientation:

secondly, to justify the optimal operating conditions to produce this highly oriented and transparent fiber in a continuous basis. A C. W. Brabarder model 200 extruder and a reservoir, designed not to interfere with the wine-glass convergent flow pattern of the polymer melt, were used for continuous extrusion. Sets of 3 inch long dies with inside diameter of 0.052 to 0.1 inch and sets of 1 inch or less short dies with 0.052 inside diameter were employed for the fiber spinning. First evidence of transparent and highly oriented strand was found inside a 3 inch long die while plugging occurred during the extrusion of the polymer melt near the melting point. In this batch case, simultaneously flow orientation and shear induced crystallization is probably responsible for the unusual properties of the transparent strand. Dissert. Abstr.

N76-30371*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECTS OF TETRAAMINE CROSSLINKING AGENTS ON THE THERMOMECHANICAL PROPERTIES OF PMR POLYIMIDE COMPOSITES

Peter Delvigs 1976 13 p refs Presented at Chemistry and Properties of Crosslinked Polymers Symp. at the 172d Natl. Meeting of the Am. Chem. Soc., San Francisco, 29 Aug. - 3 Sep. 1976

(NASA-TM-X-73477; E-8738) Avail: NTIS HC $3.50 CSCL 07C

The effects were investigated of partial substitution of tetraamine crosslinking agents for diamine reactants on the thermomechanical properties of PMR polyimide resins and graphite fiber-reinforced composites. The effect of tetraamine content on isothermal weight loss, glass transition, and softening temperatures of neat resin samples is discussed. Composites were fabricated using PMR methodology. Monomeric solution of various stoichiometric ratios was used to impregnate Hercules HTS graphite fiber. The mechanical property retention characteristics of the composites at 316 C (600 F) are described. Author

N76-30372*# IIT Research Inst., Chicago, Ill.

SPACE STABLE THERMAL CONTROL COATINGS

Y. Harada 26 Jul. 1976 28 p refs

(Contract NAS8-31906)

(NASA-CR-149978; IITRI-D6118-4(TAR)) Avail: NTIS HC $4.00 CSCL 11C

The MOX method, i.e., the use of zinc and titanium oxalate precursors, has the distinct advantages of simple and rapid processing, and of controlled pigment particle size. The chemical identify of TiOX was determined. The Zn/Ti ratio effect on the reflectance spectra and ultraviolet irradiation stability in vacuum for Zn2TiO4 was examined. Optimized processing parameters are considered for reproducibly obtaining a pigment of the most desirable optical properties and behavior. Author

N76-30373# Rockwell International Corp., Anaheim, Calif. Strategic Systems Div.

MATERIAL REQUIREMENTS AND PROCESS CONTROLS FOR EPOXY ADHESIVES USED IN HYBRID MICROCIRCUITS

J. J. Licari, B. L. Weigand, and K. L. Perkins Jun. 1976 17 p refs Presented at Hybrid Microcircuit Symp., Fort Monmouth, N. J., 8-9 Jun. 1976

(X76-681/201) Avail: NTIS HC $3.50

The key adhesive material and process parameters considered to be most critical to hybrid microcircuit reliability were defined, tests established for their measurement, and a guideline specification written. A review is given of the technical basis for the preparation of the specification with emphasis on bond strength retention under various military stress conditions, long-term electrical stability, thermal stability, and outgassing effects on devices. Author

N76-30374# Battelle Columbus Labs., Ohio. Metals and Ceramics Information Center.

ENGINEERING PROPERTY DATA ON SELECTED CERAMICS. VOLUME 1: NITRIDES

Mar. 1976 114 p refs

(Contract DSA900-75-C-1803)

(AD-A023773; MCIC-HB-07-Vol-1) Avail: NTIS CSCL 11/2

This publication is intended to provide a convenient source of reliable, up-to-date property data on nitride ceramics for use in engineering work. Its issuance constitutes completion of the first phase in a program to update and upgrade the Databook 'Engineering Properties of Ceramics' which was issued in 1966 both as AFML-TR-66-52 and as an American Ceramics Society publication. The nitrides are compounds of other elements with nitrogen. The more common of the single nitrides are those of aluminum, boron, silicon, hafnium, titanium, zirconium, vanadium, niobium, tantalum, chromium, molybdenum, tungsten, thorium, plutonium, and uranium. Of these boron nitride (BN) and silicon nitride (Si3N4) are presently most important in engineering usage and have received greatest attention in ceramic development. Properties of the nitrides as presented are generally divided into the categories of physical, thermal, mechanical, and chemical. The physical properties include crystal structure, density, and melting or sublimation point. The thermal properties include specific heat, thermal conductivity, and thermal expansion. The mechanical properties include strength, elastic modulus, hardness, creep, and fracture mechanics parameters. The chemical properties include oxidation and corrosion resistance data, and general compatibility information. GRA

N76-30375# Explosives Research and Development Establishment, Waltham Abbey (England).

THE COMPATIBILITY OF LOCTITE SEALANTS WITH EXPLOSIVES

N. J. Blay and E. F. Pembridge Jan. 1974 17 p refs

(ERDE-TR-168; BR43689) Avail: NTIS HC $3.50

The explosives compatibility properties of a number of commercially obtainable sealants, marketed under the trade name of Loctite, are discussed and reported. The sealants are anaerobic adhesives based upon acrylate acid diesters. Tests were conducted on both liquid and polymerized sealants. It was found that, as a rule, the sealants can be expected to be compatible with high explosives (except amatols), and with single-, double-, and triple-base propellants, plastic propellants, pyrotechnics, gunpowder, and most initiatory composition. Author (ESA)

N76-30376# Naval Undersea Center, San Diego, Calif.

A STUDY OF MOLECULAR PARAMETERS INFLUENCING POLYMER DRAG REDUCTION Research Report, Sep. 1971 - Apr. 1973

Robert H. Wade Jul. 1975 40 p refs

(AD-A020813; NUC-TR-473) Avail: NTIS CSCL 07/3

The effects of three molecular parameters on drag reduction were studied under turbulent-flow conditions. Drag reduction capability of linear polymers is altered by branching. Many short side chains decrease efficiency, while fewer but long branches increase it. The drag reduction of polyelectrolytes can be reversibly destroyed or enhanced by changes in configuration resulting from changes in pH or ionic strength or by complexing with counter-ion polyelectrolytes. Cross-linking can enhance or destroy the drag-reducing capability of a linear molecule, depending on the degree of cross-linking. Polymer degradation in turbulent flow is somewhat less in branched and cross-linked molecules than in linear ones. GRA

N76-30377# Naval Intelligence Command, Washington, D.C. Translation Div.

MICROHETEROGENEITY AND STRUCTURE FORMATION IN AMORPHOUS POLYURETHANE BLOCK COPOLYMERS

E. G. Gubanov, B. Ya. Teitelbaum, and A. G. Sinaiskii 4 Feb. 1976 7 p refs Transl. into ENGLISH from Vysokomol. Soedin. (USSR), no. 8, 1970 p 623-625

(AD-A021185; NISC-Trans-3771) Avail: NTIS CSCL 07/3

The authors have shown in their earlier work (1) that crystallization of at least one block components of a copolymer changes some properties of the whole copolymer. For example, the glass transition temperature (Tc) of one component could decrease in the course of crystallization the Tc of another component which is characterized by much lower Tc. The observed phenomenon was explained by a concentration of homogeneous blocks in microvolumes, i.e., an appearance of the microheterogeneity in block copolymers during crystallization. A division of the block copolymer components into microregions was also observed among amorphous copolymers, with components markedly different with respect to polarity (2). It could be expected that appearance and development of the microheteroge-

neity in similar systems would produce characteristic changes in thermomechanical properties. In this work amorphous block copolymers consisting of poly(ethylene adipate) and poly(propylene phthalate), crosslinked with OCN(CH2)6NCO. GRA

N76-30378# Pennwalt Corp., King of Prussia, Pa. Research and Development Dept.
SYNTHESIS, PROPERTIES, AND STRUCTURAL CHARACTERIZATION OF LEAD (2) BIS(DISPHENYLPHOSPHINATE), Pb(OP(C6H5)2O)2
P. Colamarino, P. L. Drioli, W. D. Benzinger, and H. D. Gillman Dec. 1975 25 p refs
(Contract N00014-69-C-0122; NR Proj. 356-408)
(AD-A020186; TR-18) Avail: NTIS CSCL 07/3

Pure polymeric Pb(OP(C6H5)2O)2 has been prepared, and its structure has been determined by three-dimensional single-crystal X-ray techniques. The compound crystallizes in the triclinic space group P(1 bar). Least squares refinement of 3737 independent reflections gave a final R factor of 3.5%. The structure consists of polymeric chains of lead atoms linked by double phosphinate bridges. The coordination around each lead atom can be described as a distorted trigonal bipyramid with a lone pair of electrons occupying an equatorial site. Mean equatorial and axial Pb-O distances are 2.233(6) and 2.435(6) A, respectively. The corresponding O-Pb-O angles are 88.2(2) and 167.6(2) degrees. This polymer was found to dissociate in solution, and its infrared spectrum suggests that changes in the mode of coordination of the phosphinate groups take place upon dissolution. Other forms including crystalline and amorphous modifications were found in the solid state. GRA

N76-30379# Pennwalt Corp., King of Prussia, Pa. Research and Development Dept.
THE SPECIFIC HEAT OF DISORDERED ANTIFERROMAGNETIC CHAINS: POLY(METAL PHOSPHINATES)
T. S. Wei, J. C. Scott, A. F. Garito, A. J. Heeger, and P. Annelli Dec. 1975 20 p refs
(Contract N00014-69-C-0122; NR Proj. 356-408)
(AD-A020183; TR-15) Avail: NTIS CSCL 07/2

The inorganic transition-metal polymers, poly(metal phosphinates), comprise a unique and versatile class of new materials. In particular, three poly(chromium phosphinates) have been shown to form linear polymeric molecules which may be described in terms of spin chains with antiferromagnetic interactions. The specific heat of these materials and of their non-magnetic analogues, poly(zinc phosphinates), have been measured in the temperature range 1.6 T 10K. The vibrational contribution to the specific heat is consistent with the polymeric nature of the materials, changing from T cubed to T to the 5/2 power dependence as the temperature increases. The magnetic specific heat can then be extracted and is found to be in qualitative agreement with a model which includes disorder in the spin chains. It is believed that this is the first measurement of the specific heat of a disordered one dimensional magnetic system. GRA

N76-30380# Rockwell International Corp., Canoga Park, Calif.
INORGANIC HALOGEN OXIDIZER RESEARCH Annual Report, 1 Jan. - 31 Dec. 1975
K. O. Christe, C. J. Schack, and R. D. Wilson 26 Jan. 1976 150 p refs
(Contract N00014-70-C-0294)
(AD-A020482; R-9881) Avail: NTIS CSCL 07/2

Major breakthroughs were achieved in the field of NF4(+) chemistry and solid propellant NF3-F2 gas generators for chemical HF-DF lasers. The novel concept of a self-clinkering NF3-F2 generator, based on the new (NF4)2 SNF6 salt, was developed, and a feasible method of producing (NF4)2 SnF6 by metathesis was established. Work on the UV-photolysis of NF3-F2-Lewis acid systems resulted in an economic process for the production of pure NF4BF4 on a pound scale, thus providing the material required for its development as a NF3-F2 gas generator. The following novel NF4(+) salts have been synthesized: (NF4)2SnF6, (NF4)2GeF6, NF4SnF5, NF4GeF5, NF4PF6, NF4BiF6, and NF4Bi2F11. These and some of the known NF4(+) salts have been or are presently being characterized. The concept of displacing NF3 and F2 from NF4BF4 by low-melting eutectic mixtures was examined, and the syntheses of (NF4)2SiF6, NF4HF2, (N2F3)2GeF6, and N2F3BF4 were attempted. Low-temperature UV-photolysis was also successfully applied to the synthesis of the novel dioxygenyl salt O2+GeF5-, which was thoroughly characterized. Evidence was obtained for a metastable gaseous species at room temperature containing an infrared active O-O multiple bond. An improved oxidizer for closed-cycle submarine propulsion systems was found and proposed to DARPA for further study. The fluorination of UF4 and UO2F2 to UF6 by N2F2 was briefly investigated. Study of the PtF6-XeOF4 reaction system and the crystal structure determination of (BrF2)2 GeF6 was completed. GRA

N76-30381# Rutgers Univ., New Brunswick, N.J. Dept. of Mechanics and Materials Science.
THE THERMAL ASPECTS OF THE WEAR OF PLASTIC MATERIALS UNDER VERY HIGH CONTACT PRESSURE AND SLIDING VELOCITY Final Report, 23 Sep. 1974 - 31 Oct. 1975
Yu Chen 5 Jan. 1976 17 p refs
(Grant DAHC04-75-G-0036)
(AD-A022388; ARO-12860.1-RE) Avail: NTIS CSCL 19/4

A mathematical model depicting the heat conduction in the rotating band of a projectile and the gun is formulated. A solid inner cylinder in contact with a hollow outer cylinder, both infinitely long, are used to represent the gun tube and the rotating band. The frictional heat flux is imparted to these cylinders at an initial instant and the temperatures in each cylinder are analyzed. The boundary value problem is solved first to generate the eigenfunctions for solving the initial value problem. It is found that the convergence of the temperature solutions are too slow to give accurate data at this time. Further results will be published in the future. Author (GRA)

N76-30382# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
ADSORPTION AND DESORPTION RATES OF POLYSTYRENE ON FLAT SURFACES Final Report
Warren H. Grant, Leslie E. Smith, and Robert R. Stromberg 3 Jan. 1975 10 p refs Repr. from Faraday Discussions of the Chem. Soc., no. 59, 1975 P 209-217 Sponsored in part by AROD
(PB-252442/9) Avail: NTIS HC $3.50 CSCL 07D

The rates of adsorption and desorption of polystyrene were measured in cyclohexane and benzene sollutions. Relatively long times were required to attain maximum adsorbance values for adsorption of both low and high molecular weight polymer on a solid chrome surface under theta conditions. This was interpreted to indicate a molecular reorientation during the adsorption process. More rapid attainment of maximum adsorbance values on a mercury surface was attributed to participation of the liquid mercury surface in accommodating the changing polymer conformation. The rates of desorption were very slow and were dependent on the surface populations as determined by the adsorbance values. GRA

N76-30383# New York Univ., N.Y. Div. of Applied Science.
FEASIBILITY STUDIES RELATIVE TO USING NEW POLYMERS AND PLASTICS AS INHIBITORS TO REPLACE COMPOSITIONS PRESENTLY BEING USED WITH ROCKET PROPELLANT GRAINS OF 155 mm HE RAP(ROCKET ASSISTED PROJECTILE) Final Report, May - Dec. 1975
Walter Brenner and Barry Rugg 1975 28 p
(Contract DAAA21-75-C-0267)
(AD-A023076) Avail: NTIS CSCL 11/9

The purpose of this contract is to carry out feasibility studies relative to using new polymers and plastics as inhibitors to replace compositions presently used with propellant grains of 155mm HE RAP (Rocket Assisted Projectile). There is a need to enhance the effectiveness of the presently employed inhibitor compositions both as regards long range performance and application technology to the grain. GRA

N76-30384# Rensselaer Polytechnic Inst., Troy, N.Y. Div. of Materials Engineering.
TRANSITION METAL IONS AND HETEROGENEOUS NUCLEATION IN GLASS Final Report, 1 Jan. 1973 - 31 Dec. 1975
Robert K. MacCrone Jan. 1975 15 p refs

(Contract N00014-67-A-0117-0017; NR Proj. 032-538)
(AD-A021978; RPI-JBD35-4) Avail: NTIS CSCL 11/2

The research carried out during the tenure of the support is described. The work shows (1) that the magnetic ions in the glasses studied (iron ions) are contained in well defined structures, namely diads and triads. The physical properties of these structures are described and the relevant parameters determined. (2) That during nucleation heat treatments, there is very little change in the structure of the glass as determined by magnetic measurements. Only oxidation of Fe(++) yielding Fe(3+) takes place, but this seems to play a vital role in determining the final crystalline product phase. (3) On crystallisation, Fe3O4, Y-Fe2O3 and some spinel form depending upon the temperature of nucleation. These phases determine the majority crystalline phase of the glasses. In conclusion, there is much in the magnetic properties of these glasses which are imperfectly understood. Finally, a list is given of students and research associates who worked on the project and their thesis abstracts. Also given are the abstracts of the technical reports and papers. GRA

N76-30385# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Macromolecular Science.
PYROELECTRICITY AND PIEZOELECTRICITY IN NYLON 11
Morton H. Litt, Che-Hsiung Hsu, and P. Basu 17 Mar. 1976 27 p refs
(Contract N00014-75-C-0842)
(AD-A022430; TR-5) Avail: NTIS CSCL 11/9

Pyroelectric and piezoelectric properties of poly(vinylidene fluoride) have been widely reported in the literature. Investigations on similar properties in other classes of polymers have been relatively restricted. This paper describes preliminary pyroelectric and piezoelectric results obtained with commercial films of Nylon 11. The results of dielectric constant measurements in the temperature range of 20 C - 130 C are also presented. Nylon 11 films show quite high pyroelectricity and the evidence indicates that there is probably dipole orientation in crystalline regions. Charge injection or volume polarization, as well as dipole orientation was shown to contribute to the pyroelectricity unless the sample was thoroughly relaxed. GRA

N76-30386# Case Western Reserve Univ., Cleveland, Ohio.
FUNDAMENTAL STUDY OF TOLUENE NITRATION Final Report, 1972-1974
George A. Olah Feb. 1975 16 p
(Contract DAAA21-72-C-0528)
(AD-A021145) Avail: NTIS CSCL 07/3

The objectives of this study were to conduct research into the basic aspects of the mono- di- and trinitration of toluene (and benzene), to clarify the mechanism, and to try to minimize oxidative side reactions. GRA

N76-30387# Horizons, Inc., Cleveland, Ohio.
POLY(FLUOROALKOXYPHOSPHAZENE) LIP SEAL MATERIALS Final Report, 30 Jan. 1974 - 29 Jan. 1975
John C. Vivic and Kennard A. Reynard Oct. 1975 69 p refs
(Contract DAAG46-74-C-0056)
(AD-A021001; AMMRC-CTR-75-26) Avail: NTIS CSCL 07/3

The objective of this program was to develop poly (fluoroalkoxyphosphazene) terpolymer compounds suitable for lip seal applications over a temperature range of -70F to 250F with a projected lifetime of 1000 hours or more. Compounding studies with (CF3CH2O)2PN-(HCF2C3F6CH2O)2PN)n terpolymers indicate the objective can be met. Candidate seal compounds were developed that had good original stress-strain properties and retained these properties after aging at 350F in air for up to 500 hours. The ((CF3CH2O)2PN-(HCF2C3F6CH2O) 2PN)n terpolymer lip seal compounds exhibited low volume swell and weight change in the ASTM test fuels at 73F and good hydrolytical stability at 212F and 100% relative humidity. Low temperature compression set tests at -70F and Gehman test results indicate these compounds will be serviceable at -70F. Material evaluation tests have not been correlated to actual service life; therefore the ((CF3CH2O)2PN-(HCF2C3F6CH2O)2PN)n terpolymer compounds developed on this program should undergo dynamic testing to complete qualifications. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N76-30388*# Newark Coll. of Engineering, N.J.
SOOT FORMATION IN THE METHANE OXYGEN AND METHANE/OXYGEN/HYDROGEN FLAME Final Report
L. Dauerman and G. E. Salser 31 Aug. 1972 46 p refs
(Grant NGR-31-009-007)
(NASA-CR-148729) Avail: NTIS HC $4.00 CSCL 21I

The feasibility of using methane, recovered from carbon dioxide by the Sabatier-Senderens reaction, was investigated as a fuel in a reaction control engine. A problem to be avoided is the emission of soot particles. It is thought that such particles would remain in the environment of the spacecraft and, thereby, adversely affect optical sightings and possibly have an effect upon communications. The initial studies were of a practical nature. The first was the influence of the spatial arrangement of the fuel and oxygen injectors on soot formation. In the second study, inhibition of soot formation was considered. Considering the given situation, it was impractical to use an additive. However, since methanol combustion does not produce soot, and methanol can be produced from methane in situ, the possibility that methanol could act as an inhibitor was studied. In the third study, since these are restartable engines, the effect of shutdown on the rapidity of soot formation was studied. Author

N76-30389*# Battelle Pacific Northwest Labs., Richland, Wash.
A STUDY OF LIQUID PROPELLANT AUTOIGNITION Final Report
D. H. Lester, A. G. Gibbs, and D. L. Lessor May 1975 266 p refs
(Contract NAS10-8591)
(NASA-CR-148711) Avail: NTIS HC $9.00 CSCL 21I

Data and theory pertinent to the autoignition of liquid oxygen/liquid hydrogen and liquid oxygen propellants were reviewed. Physical models of the processes supporting or contributing to autoignition were developed. Emphasis was placed on the description of the physical environment and its relationship to the autoignition phenomenon. Author

N76-30390# Institute of Gas Technology, Chicago, Ill.
ALTERNATIVE FUELS FOR AUTOMOTIVE TRANSPORTATION: A FEASIBILITY STUDY. VOLUME 1: EXECUTIVE SUMMARY
J. Pangborn and J. Gillis Jul. 1974 33 p refs 3 Vol.
(Contract EPA-68-01-2111)
(EPA-460/3-74-012a-Vol-1) Avail: NTIS HC $4.75

Potentially feasible alternative fuels are assessed for their economic and technical practicality and the most promising fuels are recommended for three specific time frames. A model for energy supply and demand by market sectors was devised, and cost estimates were made. It was concluded that alternative automotive fuels from domestic sources can alleviate petroleum imports. Coal, oil shale, and fissionable nuclear fuels are adequate resources, while the preferred fuels are gasoline and hydrocarbon distillates, methanol, and hydrogen. An executive summary of this study is presented. ERA

N76-30391# Institute of Gas Technology, Chicago, Ill.
ALTERNATIVE FUELS FOR AUTOMOTIVE TRANSPORTATION: A FEASIBILITY STUDY. VOLUME 2: TECHNICAL SECTION
J. Pangborn and J. Gillis Jul. 1974 283 p refs 3 Vol.
(Contract EPA-68-01-2111)
(EPA-460/3-74-012b-Vol-2) Avail: NTIS HC $15.00

The technical details of a study to find suitable non-petroleum-based fuels which are available on the long term from domestic sources are presented. Factors considered include: (1) energy demand and supply; (2) fuel availability; (3) fuel synthesis technology; and (4) the physical, chemical, and combustion properties of the fuels. ERA

N76-30392# Institute of Gas Technology, Chicago, Ill.
ALTERNATIVE FUELS FOR AUTOMOTIVE TRANSPORTATION: A FEASIBILITY STUDY. VOLUME 3: APPENDICES
J. Pangborn and J. Gillis Jul. 1974 114 p refs 3 Vol.
(Contract EPA-68-01-2111)
(EPA-460/3-74-012C-Vol-3-App) Avail: NTIS HC $8.75

Various data collected in a study of domestic, non-petroleum based automotive fuels are presented in two appendices: properties of potential alternative fuels for automotive transportation; and detailed process descriptions and economics for candidate fuels from coal and oil shale. The combustion characteristics, the overall energy balance and efficiency, the pollution problems, and an economic analysis are presented for each of the candidate fuels from coal and oil shale. ERA

N76-30393# Institut Franco-Allemand de Recherches, St. Louis (France).
CARTRIDGELESS PROPELLANTS, COMBUSTIBLE CARTRIDGES AND COMBUSTIBLE ELECTRIC PROPELLANT IGNITERS [HUELSENLOSE TREIBLADUNGEN, VERBRENNBARE HUELSEN UND VERBRENNBARER ELEKTRISCHER TREIBLADUNGSANZUENDER]
W. Kegler 6 Oct. 1975 11 p In GERMAN Presented at the symp. on 'Innenballistische Leistungssteigerung der Rohrwaffen', Pfinztal-Berghausen, West Ger., 30 Sep. - 2 Oct. 1975
(ISL-CO-214/75) Avail: NTIS HC $3.50

Progress is reported in the fields of cartridgeless ammunition (plastic bonded compact of normal powder with an auxiliary charge) and combustible cartridges (plastic foam container with explosive). The ballistic performance of several types of combustible cartridges is listed. A survey is given of the adaptation of the propellants to several types of projectiles for cartridgeless ammunition. The possibility of exact determination of self ignition (cook-off) is discussed. ESA

N76-30394# Institut fuer Chemie der Treib- und Explosivstoffe, Pfinztal (West Germany).
STRUCTURE AND MECHANISM OF COMBUSTION MODIFIERS Interim Report [STRUKTUR- UND WIRKUNGSWEISE VON ABBRANDMODIFIKATOREN]
A. Pfeil and N. Eisenreich 31 Dec. 1975 54 p refs In GERMAN
(Contract T/R-720/R-7300/33034)
(ICT-12/75-IR-1) Avail: NTIS HC $4.50

A literature review of structure and mechanism of combustion modifiers of double base solid propellants is given. It is shown that the modifiers must be active in the propellant, and/or the propellant surface (fizz-zone), and/or in the zone immediately above the surface; consequently, the modifier structure and action are closely interrelated. The structure of copper salicylate tetrahydrate is discussed and laser-pyrolytic investigations are presented. ESA

N76-30395# Wentworth Inst., Boston, Mass.
A CAPACITOR DISCHARGE SQUIB FIRING UNIT
Owen R. Green 1 Apr. 1975 23 p refs
(Contract F19628-73-C-0232; AF Proj. 7659)
(AD-A021906; AFCRL-TR-75-0620; SR-2) Avail: NTIS CSCL 19/1

In 1973, Wentworth Institute (WI) was asked to produce a practical, reliable, off-the-shelf CD unit for firing standard squibs. Design objectives included simulteneous four-bridgewire firing capability, one-second recovery, 0.5A supply drain, and three outputs. A +28 VDC supply is required. The Model CD-B is described: a +28 volt firing command closes a selected firing relay for 30 ms; at 20 ms, the firing capacitors are discharged into the squib circuit through an SCR. The unit includes standard safety features (ARM/SAFE relay and 100 k-ohm squib isolation), and monitors for both capacitor voltage and squib current. Nine CD units have been built by WI for use in sounding rockets. Four flights have used the CD units for primary squib ignition; no malfunctions have been indicated. CD squib current data is shown for eight in-flight firings. This data suggests that a reduction in the size of the CD unit may be possible. (The Model CD-B measures 10.2 x 12.7 x 5.7 cm (4 x 5 x 2.25 in.) and weighs 0.7 kg (24.7 oz.)). Author (GRA)

N76-30396# Stanford Research Inst., Menlo Park, Calif.
SENSITIVITY FUNDAMENTALS Final Technical Progress Report, 1 Jul. - 31 Dec. 1975
T. Mill, D. S. Ross, N. A. Kirshen, C. M. Tarver, and R. Shaw Jan. 1976 92 p refs
(Contract N00014-70-C-0190; SRI Proj. PYU-8525; NR Proj. 092-537)
(AD-A022704) Avail: NTIS CSCL 19/1

Thermal decomposition of liquid 1,1-Dinitropropane (DNP) at 1 and 1,000 atm and 135-155 C gives over 90% propionic acid. The reaction is accelerated by pressure and by added water. 2,2-DNP decomposed slowly at 165 C to give only acetone, NO and NO2. Reactions of isobutane and neopentane with NO2-N2O4 indicated that HNO3 is an intermediate oxidizer in these reactions. The gas-phase decompositions of four dinitropropanes have been studied, using low-pressure pyrolysis. Detonation failure diameters of nitromethane, 1,1-dinitroethane, 1,1-dinitropropane, and 2,2-dinitropropane were measured for the cases of heavy confinement in thick-walled lead cylinders and Dremin:s weak shell confinement. Shock-induced reaction times and failure wave velocities in decaying detonation wave were also measured and used in the Dremin-Trofimov model to calculate failure diameters of the unconfined liquids. GRA

N76-30397# United Technologies Corp., Sunnyvale, Calif. Chemical Systems Div.
SOLID REACTANTS FOR FLUORINE GAS GENERATORS Final Report, 2 Jun. 1975 - 2 Feb. 1976
C. E. Fogle and J. D. Breazeale 15 Mar. 1976 113 p refs
(Contract N60921-75-C-0224; NSWC Proj. 233-0132-75)
(AD-A022099; CSD-2564-FR) Avail: NTIS CSCL 19/1

A program has been conducted to explore the possibility of using solid reactants, other than those currently under consideration, for the preparation of fluorine equivalent gas (F, F2, or NF3) and to evaluate the potential of promising candidates. A list of 32 candidates was compiled which was reduced to 3, KBrF6, KClF4, and LiMnF5, by applying pre-established selection criteria based on toxicity, cost, safety, vapor pressure or melting point, and others. Excellent properties and performance were obtained from a formulation based on KBrF6 yielding approximately 13% by weight equivalent fluorine (18 percent by weight active fluorine) with a potential of over 25 percent active fluorine through composition variation. This approach was abandoned owing to the lack of information related to the effect of the species BrF on HF-DF laser output. Similarly, although equally good properties and performance could be obtained, KClF4 formulation evaluation was discontinued when it became known that ClF has a deleterious effect. The third candidate, LiMnF5, offers the possibility of the production of pure fluorine albeit at relatively low yield (about 10 weight percent) and investigations of its formulations have been pursued. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N76-30398 Stanford Univ., Calif.
X-RAY SCATTERING FROM LIQUID He-3 Ph.D. Thesis
Laurance Jay Suter 1976 143 p
Avail: Univ. Microfilms Order No. 76-18802

The experiment reported here is an investigation into the structure of liquid He3. X-rays were scattered from a sample of He-3 which was cooled to temperature ranging from 0.05 K to 1.2 K. By measuring the scattered intensity as a function of angle and normalizing it with data collected by scattering from neon gas at 77 K, the structure factor (S(k)), of the liquid was found. The small k structure factor was found to be in rough agreement with the predictions of the Landau theory of Fermi liquids. However, the slope of the data consistently lies below the predicted slope. The data even lies below the predicted lower bound of S(k) (based on the Landau theory of Fermi Liquids). It is speculated that the real source of this difference is the existence of high frequency excitations which have been neglected in the calculations of S(k). Dissert. Abstr.

N76-30399 Kansas State Univ., Manhattan.
MERCURY SPECTRA AND PHOTOSENSITIZED REACTIONS IN LOW TEMPERATURE MATRICES Ph.D. Thesis
Timothy Jones, Jr. 1976 147 p
Avail: Univ. Microfilms Order No. 76-17131

The absorption spectra of Hg trapped in low temperature matrices of poor, moderate and efficient quenchers of excited Hg have been recorded. Host molecules include Ar, Kr, Xe, N2, CO, C1 to C6 alkanes (including the C4 and C5 branched chains), straight chain C2 to C6 alkenes, and acetone. The spectra consist of essentially two or three multiplet structures. Doublet or triplet bands appeared in the vicinity of the Hg 6 1s0 to 3p1 transition at 2,536.5 A in all of the matrix spectra (N bands). In some of the matrix spectra, very weak bands appeared about 200 A to the blue of this line. Stronger satellite bands appeared from 2,250 to 2,100 A in all of the matrix spectra. The latter two bands are designated S bands. The longer wavelength component of the N bands was attributed to the host perturbed Hg 6 (1s0 to 3p1 transition. Transitions between dimeric or polymeric Hg atoms appear to be responsible for both the weaker and stronger S bands. Dissert. Abstr.

N76-30400 Ohio State Univ., Columbus.
CRYSTAL FIELD ORDERING IN SOLID HYDROGEN AT LOW TEMPERATURES Ph.D. Thesis
Avijit Mukherjee 1976 141 p
Avail: Univ. Microfilms Order No. 76-18013

A pulsed nuclear magnetic resonance study was made on samples of solid hydrogen containing approximately 0.25 percent and 0.17 percent orthohydrogen. The Free Induction Decay (FID) signal was studied as a function of temperature in the temperature range 4.2K to 40mK. It was found that below a certain transition temperature, the FID signal exhibited structure of a damped oscillatory nature. This structure becomes more prominent as the temperature is lowered, and this is shown to be due to decreased damping of the FID lineshape. Dissert. Abstr.

N76-30401 Ohio State Univ., Columbus.
THE SURFACE OF LIQUID He4 NEAR THE ABSOLUTE ZERO Ph.D. Thesis
Panayotis P. Fatouros 1976 135 p
Avail: Univ. Microfilms Order No. 76-17981

The surface tension of liquid He4 was measured as a function of temperature in the range of $00.2 < T < 0.35$ K. A theory of scattering of a low energy He4 beam at the superfluid He4 surface is developed which results in an effective one body Schrodinger equation. For a given density profile, the probability of elastic scattering R is calculated by the numerical solution of this integrodifferential equation and compared with recent measurements. The theory predicts that R depends on both the parallel and perpendicular momentum of the incoming atom and that for certain angles of incidence a total reflection exists. The technical question of generating a pure He3 beam is examined via a simple model and some preliminary data are presented. Measurements of the surface sound velocity and surface tension over a wide range of concentrations are used to obtain values for the effective mass and binding energy of the adsorbed He3. Dissert. Abstr.

N76-30402 Cooper Union, New York.
ROLE OF DIFFUSION ON AEROSOL COLLECTION BY WATER SPRAY Ph.D. Thesis
David Rimberg 1976 130 p
Avail: Univ. Microfilms Order No. 76-17326

The role of diffusion on collection of submicron aerosol by water spray was examined. This effect was investigated as a function of droplet relative velocity for 1.099 micron and 0.500 micron aerosol. Experimental results indicated enhancement of collection efficiency was maximum at a relative velocity of approximately 1,600 cm/sec for mono disperse 0.500 micron aerosol. The effect of particle size on collection efficiency at constant relative velocity was evaluated by using data from literature. Dissert. Abstr.

N76-30403# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.
A BIBLIOGRAPHY ON AUTOMATED MEASUREMENTS 1 JUL 1969 - 1 JUL 1974
Gloria A. Teamer and Anne Y. Rumfelt Apr. 1976 158 p refs
(PB-252044/3; NBSIR-75-801) Avail: NTIS HC $6.75 CSCL 14B

The bibliography lists approximately 1,000 citations pertinent to the field of automated measurement of electrical/electronic quantities and characteristics. In addition, approximately 400 citations are included that should be helpful in applying computers to the automation of measurements. Only references appearing in the open literature between July 1, 1969, and July 1, 1974, are listed. GRA

N76-30404# Bureau of Mines, Tuscaloosa, Ala. Metallurgy Research Lab.
WASTE GLASS AS A RAW MATERIAL FOR LIGHTWEIGHT AGGREGATE
K. J. Liles and M. E. Tyrrell Jan. 1976 8 p refs
(PB-250692/1; BM-RI-8104) Avail: NTIS HC $3.50 CSCL 13C

Production of lightweight aggregate from the glass fraction of municipal incinerator residues was undertaken by the Bureau of Mines to use the great amount of glass generated by incineration. A mixture of 78 percent glass, 20 percent clay, and 2 percent sodium silicate was pelletized, then expanded by exposure to a temperature of 1,550 F for 15 minutes. The resulting lightweight material weighted 38 lb/cu ft and exhibited excellent pore structure. Concrete test cylinders made from the lightweight aggregate had a unit weight of 104 lb/cu ft and a compressive strength of 2,550 lb/sq in after a 28-day steam curing treatment. GRA

N76-30405# National Swedish Inst. for Building Research, Stockholm.
REINFORCEMENT OF CONCRETE WITH SISAL AND OTHER VEGETABLE FIBRES
Lennart Nilsson 1975 74 p refs
(PB-251338/0; D14-1975; ISBN-91-540-2513-3) Avail: NTIS HC $4.50 CSCL 13C

The cultivation areas, climatic requirements, production volumes and technical properties of different vegetable fibers were studied. Randomly admixed and also longitudinally aligned fibers of steel, plastics and glass fibers are used increasingly as reinforcement in concrete. Short organic fibers should have the same field of application. Simple tests were made on concrete reinforced with sisal by casting beams and flexurally testing these. The results indicate that quite significant reinforcement effects can be obtained. GRA

N76-30406# Texas Univ., Austin. Center for Highway Research.
COMPARISON OF THE FATIGUE TEST METHODS FOR ASPHALT MATERIALS
Byron W. Porter and Thomas W. Kennedy Apr. 1975 122 p refs Sponsored in part by FHA and Texas Highway Dept., Austin
(PB-251345/5; CFHR-3-9-72-183-4; FHWA-RD-76-S0449) Avail: NTIS HC $5.50 CSCL 13C

The results are described of an investigation comparing various commonly used fatigue tests and evaluating the relationship between creep and fatigue. It was found that the repeated-load indirect tensile test produces results comparable with other fatigue tests if the state of stress developed in the specimen is considered. A regression analysis was conducted, and an equation was developed which can be used to relate fatigue results for a variety of mixtures and test methods. A comparison of creep and fatigue results indicated that a relationship probably exists between creep and fatigue deformation and that fatigue life can possibly be estimated from creep rupture time. GRA

N76-30407# Gillette Research Inst., Inc., Rockville, Md.
FIRE ALERT SYSTEMS FOR METAL AND NONMETAL MINES Technical Report, 14 Jun. 1974 - 14 Jun. 1975
John P. Wagner, Abraham Fookson, Allan Harper, Mary May, and Roger Welker 22 Aug. 1975 177 p refs
(Contract DI-BM-SO-144131)
(PB-251715/9; BM-OFR-45-76) Avail: NTIS HC $7.50 CSCL 08I

A state-of-the-art survey on fire detection devices and gas sensing techniques is reported. Laboratory screening and systems concepts testing were performed on various detectors classified as products of combustion, optical view field and contact (or thermal) types under incipient and flaming combustion conditions. Recommendations for a mine fire detection system to protect shaft, sealed off or mined out (from spontaneous combustion of sulfide containing ores and cellulosic materials), and fuel storage areas are also included. GRA

N76-30408# Arkansas Univ., Little Rock.
ROADBED STABILIZATION LIME INJECTION CONFERENCE HELD AT LITTLE ROCK, ARKANSAS, ON AUGUST 21-22, 1975
James R. Blacklock, ed., J. B. Farris (Southern Railroad), C. Ronald Rone (Rone Engineering, Inc.), Grant M. Davis (Arkansas Univ.), Marshall R. Thompson (Illinois Univ.), Quentin L. Robnett (Ga. Inst. of Tech.), Charles E. OBannon (Arizona State Univ.), Albert F. Vickers (Arkansas Univ.), David F. Sheaff (McClelland Engineers, Inc.), Robert C. Welch (Arkansas Univ.) et al Nov. 1975 267 p refs
(Contract DOT-OST-40107)
(PB-251681/3; FRA/ORD/D-76-137) Avail: NTIS HC $9.00 CSCL 13F

Twelve technical papers were presented at the conference that document the state of knowledge and related subjects on lime pressure injection stabilization of problem railroad subsoils. The related papers are on electrochemical stabilization, finite element analysis of roadbeds and nondestructive testing of roadbed soils. These proceedings are the first to be published on the subject of lime pressure injection soil stabilization. GRA

N76-30409# National Bureau of Standards, Washington, D.C. Center for Fire Research.
A NEW CONCEPT FOR AUTOMATIC DETECTION AND EXTINCTION OF FIRES Final Report
D. Lay (Verband der Sachversicherer e. V., Cologne, West Germany) Mar. 1976 20 p refs Transl. into ENGLISH from German Conf. Paper Presented at the Intern. Seminar Probl. in Autom. Fire Detection (7th) Aachen, Germany, 5-6 Mar. 1975
(PB-251415/6; NBSIR-76-1028) Avail: NTIS HC $3.50 CSCL 13L

The use of automatic fire detectors to trigger fire extinguishment systems has gone on for many years. Automatic extinguishing systems with pratically an unlimited supply of agent suffer from the fact that these systems often continue in operation long after the fire is out, resulting in additional damage. This paper describes how such disadvantage can be avoided, to a large extent, with a modified design for permanently installed, automatic extinguishing systems which will only discharge extinguishant at the proper time and in the proper amount. GRA

N76-30410# Hydronautics, Inc., Laurel, Md.
LIFT, DRAG, AND PRESSURE DISTRIBUTION EFFECTS ACCOMPANYING DRAG-REDUCING POLYMER INJECTION ON TWO-DIMENSIONAL HYDROFOIL
Daniel H. Fruman, Marshall P. Tulin, and Han-Lieh Liu Oct. 1975 53 p refs
(Contract N00014-71-C-0063; NR Proj. 062-325)
(AD-A022433; TR-7101-5) Avail: NTIS CSCL 13/10

Lift and drag forces and pressure distribution were measured for a 10 cm. chord, 20 percent relative thickness, NACA 63 sub 4-020, symmetrical, two-dimensional hydrofoil, with and without drag-reducing polymer injection. The 200 ppm solution of Polyox WSR 301 was introduced into the foil boundary layer with an injection velocity of 10 percent of the free stream velocity. The injection slits were situated at 10 and 30 percent of the chord length. The pressure distribution data does not indicate any significant change of the separation point. It demonstrates, however, that the polymer injection always results in a significant decrease of pressure in the region aft of the injection slit. This decrease of the local pressure gives rise to a lift increase for injections made on the suction side of the foil surface and a lift decrease for injections made on the pressure side. The data suggest an elongational viscoelastic effect and a tentative explanation is offered. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N76-30411 Pennsylvania State Univ., University Park.
FREQUENCY DOMAIN ADAPTIVE DECOUPLING IN MULTIPLE OUTPUT ARRAY PROCESSORS Ph.D. Thesis
Charles R. Zentner 1975 156 p ref
Avail: Univ. Microfilms Order No. 76-17246

This research is concerned with reducing the deleterious effects of undesired signals which are received through the side lobes of an array in a multiple output array processor. Two forms of beam decoupling systems are suggested. The first is a non-iterative form which in general, requires a matrix inversion of a power spectral density matrix and the second more useful form is an adaptive algorithm that avoids the direct matrix inversion and the attendent computational requirements of this inversion. This iterative algorithm operates in the frequency domain and in real time to reduce the mean square coupling between fixed adjacent performed beams. A discrete frequency domain approach is used to avoid time-delay networks which would be needed in a time domain decoupling system. In addition, a frequency domain system offers frequency selectivity in that, at each discrete frequency bea decoupling can be effected. Dissert. Abstr.

N76-30412 Maryland Univ., College Park.
AN ENTROPY ANALYSIS OF TRACK WHILE SCAN RADARS Ph.D. Thesis
Kevin Anthony DeMartino 1975 199 p
Avail: Univ. Microfilms Order No. 76-17786

In Track While Scan (TWS) radars, the return signals are stored and correlated over multiple scans and multiple resolution cells to determine if any targets are present. The radar continues to scan the search volume after a target is detected. A basic problem of TWS systems is to determine the number of targets in the search volume. Target motion is modeled as a discrete time random process with an associated entropy H. Each resolution cell is represented by a channel model characterized by an entropy and an entropy like quantity. If the number of targets in the search volume is fixed with no targets entering or leaving the search volume, it is shown that for certain detection schemes and under certain conditions, the probability of error in determining the number of targets present approaches zero as the number of scans approaches infinity. Dissert. Abstr.

N76-30413 Iowa State Univ. of Science and Technology, Ames.
LOW COST DATA COMMUNICATIONS EQUIPMENT FOR USE ON THE ELECTRIC POWER DISTRIBUTION SYSTEM Ph.D. Thesis
Gerald Norman Johnson 1976 69 p
Avail: Univ. Microfilms Order No. 76-18279

A low cost circuit was devised which is capable of transmitting data from an outlying point on a distribution system to a central point on that power distribution system. This direction of transmission is counter to the power flow and thus upstream. A history of achievements in and longstanding need for upstream communications was traced. The upstream communications path was analyzed taking into account the effects of typical loads and transformer saturation. An upstream communications technique was proposed and demonstrated. The demonstration system is shown to be capable of sending data upstream at a 15 Baud rate on a model 7200v distribution system. Data taken on the model distribution system indicates satisfactory operation is to be expected on an operating power distribution system. Loads that vary in a precisely coded manner generate load variation signals that can be detected back at a central distribution point. In the proposed system the loading is on one phase of the distribution circuit. Both delta and wye connected distribution systems were considered. Dissert. Abstr.

N76-30414 Stanford Univ., Calif.
THE COMBINED EFFECTS OF REFRACTION AND COHERENT SCATTERING BY COLUMNAR IONIZATION DENSITY

IRREGULARITIES IN IONOSPHERIC RADIO PROPAGATION Ph.D. Thesis
David Michael Bubenik 1976 166 p
Avail: Univ. Microfilms Order No. 76-18753

The disposition of HF and VHF signals scattered by columnar ionization density irrgularities embedded in a refracting ionopsheric propagation medium is examined, using ray theory, from two viewpoints: in very long distance propagation, as a means to couple a transmitted signal into the relatively low loss ground detached radio wave propagation mode, and in the bistatic radar sounding of field aligned irregularities. It was shown that all rays propagating within a given duct are confined within an altitude zone bounded by the apogee and perigee altitudes of the associated marginal ray and that, at any given altitude, the elevation angle of propagation relative to the local horizontal of any ducted ray cannot exceed in absolute value the corresponding elevation of the marginal ray. A series of graphical overlays was devised to find these altitude and angular duct boundaries directly from ionospheric plasma frequency vs. altitude profiles.
Dissert. Abstr.

N76-30415 Maryland Univ., College Park
REALIZATION THEORY APPLIED TO THE DESIGN OF DIGITAL FILTERS Ph.D. Thesis
William Rohrman Belfield 1975 144 p
Avail: Univ. Microfilms Order No. 76-17776

Procedures for designing recursive digital filters are developed from the realization theory of linear discrete-time systems. The concept of a minimal realization of a specified pulse response is described, and methods of constructing minimal realizations are presented. It is shown that realization theory provides a unified approach to the design of recursive digital filters including multi-input multi-output filters, time-varying filters, and inverse filters. Computational aspects of the realization problem are discussed and the effects of limited numerical precision on the realization algorithm are described. A numerically efficient algorithm is presented for constructing recursive digital filters from various specifications including arbitrary frequency response data. The partial realization problem is described and methods are given for obtaining realizations when the filter order is not specified.
Dissert. Abstr.

N76-30416 Washington Univ., Seattle.
COMPUTER ESTIMATION AND MODELING OF LINGUISTIC STRESS PATTERNS IN SPEECH Ph.D. Thesis
John Yan-Poon Cheung 1975 163 p
Avail: Univ. Microfilms Order No. 76-17428

The effects of suprasegmental features are vital to speech perception, speech production and computer speech recognition, because these features provide a global, hierarchical type of analysis of speech. A computer system to analyze these features, specifically linguistic stress, is developed. The computer method estimates on a continuous scale the magnitude of stress by acoustic features. These acoustic features, which include fundamental frequency, intensity, syllable duration, are extracted by the Computer Automated Stress Extraction System (CASES). Results show that by using a sequence of nonsense syllables as test utterances, the computer estimated magnitudes of stress correlated highly with perceptual values. Futhermore, these computer estimates were stable with respect to speaker variances.
Dissert. Abstr.

N76-30417 Washington Univ., Seattle.
THE COUPLING OF ALFVEN AND COMPRESSIONAL WAVES Ph.D. Thesis
Chin Shun Lin 1975 78 p
Avail: Univ. Microfilms Order No. 76-17548

The electromagnetic wave propagation characteristics in a two component plasma (cold and hot) in the presence of an inhomogeneous magnetic field is studied. An ion distribution with an anisotropy and a density gradient is used to obtain the dispersion equation by solving the Vlasov Equation and Maxwell Equations. Using the assumption that the ion Larmor radius is much smaller than the perpendicular wave length, the dispersion equation is solved in the limit of hydromagnetic frequecies. From the solutions of the dispersion equation, a new instability is found for Alfven-like waves when the wave frequencies are less than the ion drift frequency. Alfven-like wave polarization is studied for varying parameters of anisotropy and the cold-to-hot density ratio. Owing to the inhomogeneous density and high effects, Alfven-like waves are found to couple to the drift mirror instability. It is proposed that the storm associated magnetic field oscillations with periods 100-600 seconds might be caused by the coupling of Alfven-like waves and the drift mirror instability.
Dissert. Abstr.

N76-30418*# Ohio State Univ., Columbus. ElectroScience Lab.
DEFINITION STUDY FOR SPACE SHUTTLE EXPERIMENTS INVOLVING LARGE, STEERABLE MILLIMETER-WAVE ANTENNA ARRAYS Final Report, 16 May 1974 - 30 Sep. 1975
Curt A. Levis Jul. 1976 39 p refs
(Contract NAS5-20521)
(NASA-CR-144802; ESL-3931-3; FR-3931-3) Avail: NTIS HC $4.00 CSCL 17B

The potential uses and techniques for the shuttle spacelab Millimeter Wave Large Aperture Antenna Experiment (MWLAE) are documented. Potential uses are identified: applications to radio astronomy, the sensing of atmospheric turbulence by its effect on water vapor line emissions, and the monitoring of oil spills by multifrequency radiometry. IF combining is preferable to RF combining with respect to signal to noise ratio for communications receiving antennas of the size proposed for MWLAE. A design approach using arrays of subapertures is proposed to reduce the number of phase shifters and mixers for uses which require a filled aperture. Correlation radiometry and a scheme utilizing synchronous Dicke switches and IF combining are proposed as potential solutions.
Author

N76-30419*# Ohio Univ., Athens. Dept. of Electrical Engineering.
KIM-1 INTERFACE ADAPTER TO 3-WIRE TELETYPE SYSTEMS
R. W. Burhans Aug. 1976 4 p ref
(Grant NGR-36-009-017)
(NASA-CR-148768; TM-38) Avail: NTIS HC $3.50 CSCL 17B

The KIM-1 circuit designed for use with a full duplex isolated 4 terminal system is described. Operation of the circuit with a 3 wire system in conjunction with a single +5v supply interface is discussed.
J.M.S.

N76-30420*# Axiomatix, Marina del Rey, Calif.
STUDY TO INVESTIGATE AND EVALUATE MEANS OF OPTIMIZING THE RADAR FUNCTION FOR THE SPACE SHUTTLE Final Report
31 Jul. 1976 180 p refs
(Contract NAS9-14614)
(NASA-CR-147842; R7607-4) Avail: NTIS HC $7.50 CSCL 17I

A detailed analysis of the spiral scan was performed for antenna sizes ranging from 20 inches to 36 inches in diameter and for search angles characteristic of both the radar and the communication acquisition modes. The power budgets for passive target radar detection were calculated for antenna diameters ranging from 20 to 36 inches. Dwell times commensurate with spiral scan were used for these budget calculations. The signal design for the candidate pulse Doppler system is summarized. Ground return analysis carried out for the passive target radar mode is examined, and the details are presented. A concluding description of the proposed candidate radar/communication system configuration is given.
Author

N76-30421*# Fairchild Camera and Instrument Corp., Syosset, N.Y.
SOLID STATE, CCD-BURIED CHANNEL, TELEVISION CAMERA STUDY AND DESIGN Final Report
K. A. Hoagland and H. Balopole Jul. 1976 25 p
(Contract NAS9-14844)
(NASA-CR-147839; ED-AX-75) Avail: NTIS HC $3.50 CSCL 17B

An investigation of an all solid state television camera design, which uses a buried channel charge-coupled device (CCD) as the image sensor, was undertaken. A 380 x 488 element CCD array was utilized to ensure compatibility with 525 line transmis-

sion and display monitor equipment. Specific camera design approaches selected for study and analysis included (a) optional clocking modes for either fast (1/60 second) or normal (1/30 second) frame readout, (b) techniques for the elimination or suppression of CCD blemish effects, and (c) automatic light control and video gain control techniques to eliminate or minimize sensor overload due to bright objects in the scene. Preferred approaches were determined and integrated into a design which addresses the program requirements for a deliverable solid state TV camera. Author

N76-30422*# Grambling State Univ., La. Dept. of Physics.
STUDY OF LOW FREQUENCY HYDROMAGNETIC WAVES USING ATS-1 DATA Final Technical Report
W. D. Cummings, F. Mason, and P. J. Coleman, Jr. (Calif. Univ., Los Angeles) 20 Aug. 1976 56 p refs
(Grant NGR-19-011-007)
(NASA-CR-148580) Avail: NTIS HC $4.50 CSCL 20N

Low frequency oscillations of the magnetic field at ATS-1 were analyzed for the 25 month data interval, Dec., 1966 through 1968. Irregular oscillations and those associated with magnetic storms were excluded from the analysis. Of the 222 events identified, 170 were found to be oscillating predominantly transverse to the background magnetic field. The oscillations were observed to occur most frequently in the early afternoon hours. They also seemed to occur more frequently during Dec., Jan., and Feb. than at any other time of the year. During a given event, the frequency was fairly constant. The event duration varied between a minimum of 10 min. and a maximum of 14 hrs and 26 min. During a given event the amplitude varied. Author

N76-30423*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SHARING CRITERIA AND PERFORMANCE STANDARDS FOR THE 11.7-12.2 GHz BAND IN REGION 2 Final Report
24 May 1976 48 p refs
(Contract NAS7-100)
(NASA-CR-148756; JPL-SP-43-35) Avail: NTIS HC $4.00 CSCL 17B

Possible criteria for sharing between the broadcasting-satellite and the fixed-satellite services are considered for each of several parameters in three categories: system, space station, and earth station. Criteria for sharing between the two satellite services and the three terrestrial services to which the 12-GHz band is allocated are discussed separately, first for the case of the fixed and mobile services and then for the broadcasting service. Author

N76-30424# Illinois Univ., Urbana. Dept. of Computer Science.
THE APPLICATION OF BURST PROCESSING TO DIGITAL FM RECEIVERS M.S. Thesis
Paul Lawrence Mohan Jan. 1976 62 p refs
(Contract N00014-75-C-0982)
(AD-A022391; UIUCDCS-R-76-780) Avail: NTIS CSCL 17/2

In this thesis the application of Burst processing to the problem of tuning and demodulating FM signals using digital hardware was investigated. Such digital FM receivers are shown to be conceptually sound and capable of worthwhile tradeoffs of performance and economy. These results provide the basis for the implementation of a new class of digital FM receiver. The relative performance of the different configurations of the Burst receiver is discussed. GRA

N76-30425# Naval Research Lab., Washington, D.C.
EFFECT OF THE IONOSPHERE ON SPACE SYSTEMS AND COMMUNICATIONS
John M. Goodman 1975 513 p refs Presented at the 1975 Ionosphere Effects Symp., held in Arlington, Va. 20-22 Jan. 1975
(AD-A023510; LC-75-27352) Avail: NTIS CSCL 04/1

Ionosphere effect topics include scintillation, propagation, models, irregularities, and disturbances. GRA

N76-30426# Defense Communications Engineering Center, Reston, Va.
SYSTEM IMPLICATIONS OF DEMAND ASSIGNMENT
Roy D. Rosner Jan. 1976 41 p refs
(AD-A022259; TN-76-3) Avail: NTIS CSCL 17/2

The extent to which satellite communications will play a role as part of the future switched DCS common user systems, is at least partially dependent upon the overall efficiencies which are achievable through demand assignment of resources. This Technical Note looks at some of the available demand assignment techniques for the common user environment, and develops tradeoffs and system analysis approaches which relate earth and space segment complexities and which help analyze the potential payoffs of demand assignment of satellite facilities. Author (GRA)

N76-30427# Central Research Inst. for Physics, Budapest (Hungary).
ELECTROMAGNETIC ACTION OF A SYSTEM UPON ITSELF CALCULATED BY WAVE MECHANICS
L. Janossy 1975 12 p refs Presented at the 2d Conf. on Interaction of Electrons with Strong Electromagnetic Field, Budapest, 6-10 Oct. 1975
(KEKI-75-55; Conf-751087-1; ISBN-963-371-061-8) Avail: ERDA Depository Libraries HC $4.25

It is shown that the electromagnetic reaction of an atomic system upon itself can be treated by a straightforward wave-mechanical method. Apparent difficulties arise in treatments where the atomic nuclei are incorrectly considered as classical particles. No difficulties arise, however, if the atoms are treated by many-body wave-functions, where the nucleus is one of the bodies. As an application of the method the emission of a photon by an H-atom is discussed. Author (NSA)

N76-30428# Naval Research Lab., Washington, D.C.
AUTOMATIC TRANSLATION OF ENGLISH TEXT TO PHONETICS BY MEANS OF LETTER-TO-SOUND RULES Interim Report
Honey Sue Elovitz, Rodney W. Johnson, Astrid McHugh, and John E. Shore 21 Jan. 1976 103 p refs
(RF21222401; NRL Proj. B02-15)
(AD-A021929; NRL-7948) Avail: NTIS CSCL 17/2

Speech synthesizers for computer voice output are most useful when not restricted to a prestored vocabulary. The simplest approach to unrestricted text-to-speech translation uses a small set of letter-to-sound rules, each specifying a pronunciation for one or more letters in some context. Unless this approach yields sufficient intelligibility, routine addition of text-to-speech translation to computer systems is unlikely, since more elaborate approaches embodying large pronunciation dictionaries or linguistic analysis require too much of the available computing resources. The work described here demonstrates the practicality of routine text-to-speech translation. A set of 329 letter-to-sound rules has been developed. These translate English text into the International Phonetic Alphabet (IPA), producing correct pronunciations for approximately 90% of the words in an average text sample. Most of the remaining 10% have single errors easily correctable by the listener. Another set of rules translates IPA into the phonetic coding for a particular commercial speech synthesizer. This report describes the technical approach used and the support hardware and software developed. It gives overall performance figures, detailed statistics showing the importance of each rule, and listings of a translation program and a program used in rule development. GRA

N76-30429# Illinois Univ., Urbana. Dept. of Computer Science.
AN ADDRESSABLE RING CONVEYOR M.S. Thesis
Kenneth Dean Holberger Jan. 1976 39 p refs
(Contract N00014-75-C-0982)
(AD-A021920; UIUCDCS-R-76-778) Avail: NTIS CSCL 17/2

The ARC system is a double loop, damage tolerant information network. It is designed for shipboard communication among transducers, actuators, controllers, and displays. It uses hardware tests to detect damage and to effect the best reconfiguration. It can survive any one group of adjacent hits and maintain complete connectivity among the surviving nodes. Author (GRA)

N76-30430# Mitre Corp., McLean, Va.
ATS-6 MARITIME SATELLITE EXPERIMENTS (TECHNICAL SECTION) Final Report, Jun. 1974 - May 1975
Yaroslav Kaminsky Nov. 1975 113 p refs

(Contract MA-5-38002)
(PB-250881/0; MTR-7088; MA/RD-76038) Avail: NTIS HC $5.50 CSCL 17B

Since 1969, the Maritime Administration (MARAD) of the U.S. Department of Commerce has been engaged in the evaluation of technological advances in satellite communications and electronic data processing in order to improve the competitive position of the U.S. Flag Fleet by improving the performance of the shipping process and associated logistics together with a reduction in costs of manual operations. This effort is being accomplished through a four-phase study and test program using the capabilities of existing satellites which are described. During the twelve-month period between June 1974 and May 1975, MARAD has conducted the third phase of this program using NASA's ATS-6 and ATS-5 satellites. GRA

N76-30431# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
DESIGN CRITERIA AND NUMERICAL SIMULATION OF AN ANTENNA SYSTEM FOR ONE-DIMENSIONAL LIMITED SCAN Instrumentation Papers
Giorgio V. Borgiotti 2 Dec. 1975 64 p refs
(AF Proj. 4600)
(AD-A022673; AFCRL-TR-75-0616; AFCRL-IP-243) Avail: NTIS CSCL 17/9

An analytical and numerical study was performed on a novel design scheme for an antenna for limited one-dimensional scan. The system has a number of control elements approximately equal to the minimum that are theoretically compatible with the aperture size and field of view (FOV). The radiating structure consists of a 'boot lace' lens with linear outer and circular inner profiles. This geometry plays a basic role in determining excellent scan performance over a moderate frequency band. A linear array whose size depends critically upon scan requirements and the lens focal length is located on the focal plane and is focussed onto the inner lens profile. The array is fed by a Hybrid Network (HN) performing a spatial Fourier transformation. The input ports of the HN are fed by the output ports of a Beam Forming Network (BFN) through a set of variable phase shifters. The BFN has separate input ports for the sum and difference patterns controlled independently. The system works as follows. The antenna illumination is synthesized as the weighted superposition of components illuminations or 'overlapping subarrays', each of which is due to the excitation of one of the ports of the HN. The amplitudes of the subarray excitations are fixed and determined by the power divisions provided by the BFN. Their phases are controlled by the set of variable phase shifters. A desirable feature of the scheme is that for fixed phase shifter settings, neither the beam scans nor the width changes for a moderate frequency variation. GRA

N76-30432# Florida Univ., Gainesville. Dept. of Electrical Engineering.
ELECTROMAGNETIC SCATTERING FROM IRREGULARLY SHAPED DIELECTRIC PARTICLES USING VECTOR GREEN'S THEOREM Final Report
Gray Ward 30 Oct. 1975 40 p refs
(Grant NSF GK-42718)
(PB-252413/0) Avail: NTIS HC $4.00 CSCL 20N

Scattering of electromagnetic radiation from an irregular dielectric particle whose dimensions are comparable to the incident wavelength is solved as a classical boundary value problem in which the vector Green's theorem is used as a generalized boundary condition. The inscribed sphere, the particle surface, and the circumscribed sphere divide space into four regions. Vector spherical harmonic expansions are used outside the circumscribed sphere and inside the inscribed sphere; any convenient complete set of functions can be used in the regions in between. The resulting vector equations are reduced to a set of $4I(I+2)$ linear equations where I is the maximum order of the spherical multipoles needed to describe the scattered field. GRA

N76-30433# Stanford Research Inst., Menlo Park, Calif.
FEASIBILITY STUDY OF REDUCED-STATE VITERBI DETECTION FOR CAPACITY IMPROVEMENT OF BAND-LIMITED SATELLITE COMMUNICATION CHANNELS Final Report, Jul. 1975 - Feb. 1976
S. P. Russell and S. E. Cannon Feb. 1976 61 p refs
(Contract DCA100-75-C-0057; SRI Proj. 4375)
(AD-A022622) Avail: NTIS CSCL 17/2

The applicability of a new detection method to band-limited satellite channels is analyzed and described. The method, termed reduced-state Viterbi detection, is a derivative of the Viterbi algorithm. The performance of the algorithm with idealized band-limited satellite channels was studied through analysis and simulation. The results are stated in practical terms. The cost of building a 1-Mbps version of a reduced-state Viterbi detector is estimated with the aid of a block diagram design. Reduced-state Viterbi detection appears attractive as a means of enhancing the capacity of present band-limited satellite channels: Capacity increases of 50% or more seem feasible at reasonable cost.
Author (GRA)

N76-30434# Decisions and Designs, Inc., McLean, Va.
SINGLE CHANNEL GROUND AND AIRBORNE RADIO SYSTEM (SINCGARS) EVALUATION MODEL, APPENDICES Technical Report, 7 Apr. - 15 Sep. 1975
J. O. Chinnis, C. M. Kelly, R. D. Minckler, and M. F. OConner 15 Sep. 1975 167 p ref
(Contracts N00014-75-C-0426; N00014-75-C-0149)
(AD-A020833) Avail: NTIS CSCL 17/2

This report describes the development, validation, and utilization of a multi-attribute utility model for use by the SINCGARS Special Task Force (STF) in evaluating the military utility of a series of alternative radio systems. The model was programmed to be interactive and was made available to the SINCGARS staff in order to permit additional analyses. A separate report was submitted to the SINCGARS STF on the development of this model. The major difference between that report and this report was the inclusion of appendices providing more detailed information with respect to such factors as utility functions, importance weights, values of system parameters, and technical performance characteristics. GRA

N76-30435# Mississippi Univ., University.
ELECTROMAGNETIC PENETRATION THROUGH APERTURES OF ARBITRARY SHAPE: FORMULATION AND NUMERICAL SOLUTION PROCEDURE Final Report, Sep. 1973 - Jun. 1974
D. K. Wilton and O. C. Dunaway Aug. 1975 63 p refs Prepared in cooperation with Dikewood Corp., Albuquerque, New Mex.)
(Contract F29601-74-C-0010)
(AD-A021988; DC-TN-7204-1; AFWL-TR-74-192) Avail: NTIS CSCL 20/3

A set of integral equations are derived for the equivalent magnetic current in an aperture of arbitrary shape lying in an infinite ground screen. The integral equations are cast into a matrix equation using the method of moments. An algorithm is described for the solution of the matrix equation which minimizes the machine storage required for the computation. Author (GRA)

N76-30436# RAND Corp., Santa Monica, Calif.
INTELLIGENT TERMINALS FOR NEW COMMUNICATION SERVICES
Walter S. Baer Aug. 1975 15 p refs Presented at the Natl. Telecommunications Conf., New Orleans, Dec. 1975
(AD-A022269; P-5460) Avail: NTIS CSCL 17/2

This paper describes the evolution of intelligent terminals for communication networks. It emphasizes the nontechnological barriers to adoption of new communication services made feasible by intelligent terminals. Computing and communication technologies have converged rapidly. Telephone switches are now basically computers, while most new computer systems are designed for teleprocessing. In many ways, the present deployment of large, stored-program electronic switches in the telephone network resembles the emphasis on large CPU developments in the 1950s and early 1960s. As the cost of LSI digital circuits decreases, and as new transmission modes such as satellites and cable television provide more end-to-end communication links, one expects to see logical functions distributed more widely throughout communications networks. In particular, the use of logic in terminal equipment -- i.e., intelligent terminals -- will accelerate throughout the next decade. Communications users must continually make tradeoffs between buying more information

processing at the terminal and buying more bandwidth. Over the next decade, at least, technology will favor the development of intelligent terminals, since the cost of logic is dropping faster than the cost of bandwidth. GRA

N76-30437# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
AN APPLICATION OF SCALAR RENORMALIZATION TO THE SCATTERING OF ELECTROMAGNETIC WAVES FROM A THREE-DIMENSIONALLY INHOMOGENEOUS MEDIUM WITH STRONG DIELECTRIC FLUCTUATIONS Final Report, Feb. 1974 - Aug. 1975
H. S. Fung and A. K. Fung Aug. 1975 78 p refs
(Contract DAAK02-73-C-0106; DA Proj. 4A1-61102-B-52-CA3)
(AD-A022097; RSL-TR-234-11; ETL-0020) Avail: NTIS CSCL 17/9

A theory of polarized radar scattering from a three-dimensionally randomly inhomogeneous lossy medium with strong dielectric fluctuations has been developed using the scalar renormalization method. Satisfactory agreements were obtained when theoretically computed backscattering coefficients were compared with scattering data taken from soybeans and alfalfa over incident angles from 10 degrees to 70 degrees. In view of the assumed inhomogeneous medium and the comparisons made with data, it appears that the theory, is applicable to those vegetations which can be modelled as a volume of air with randomly embedded leaves. Extension of the present theory to include depolarization effects is possible. However, the complete treatment of such a problem is very complicated. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N76-30438 City Univ. of New York.
EFFECTS OF A TRANSVERSE MAGNETIC FIELD ON THE SMALL SIGNAL ADMITTANCE OF Ga As DIODES Ph.D. Thesis
Colmon Wood-Chen Wong 1976 177 p
Avail. Univ. Microfilms Order No. 76-18406

The dc and microwave properties of GaAs (Gunn) diodes under the influence of a transverse magnetic field are studied through calculation and measurement of the device admittance with the magnetic field as parameter. The zero magnetic field static V-I characteristics of the devices tested are measured and expressed analytically. The results are then used to calculate device properties for non-zero magnetic field cases. The nonlinearity in the static characteristic is modeled in terms of a carrier temperature dependent drift mobility. The uniform electric field model in which the electric field is assumed to be uniform across the entire device is used, resulting in analytical expressions for the device admittance. Microstrip circuits are built for testing purposes. External circuit effects are taken into consideration using equivalent lumped circuit elements and appropriate sections of transmission lines. Dissert. Abstr.

N76-30439 Auburn Univ., Ala.
A PHASE-CANCELLATION SINGLE-SIDEBAND GENERATOR Ph.D. Thesis
Ellis Eugene Youngblood 1976 106 p
Avail: Univ. Microfilms Order No. 76-17708

The Hilbert transform is approximated over a decade frequency range, then used in a generic phase-cancellation type single-sideband generator producing an average side-band suppression ratio of more than 30 db. The circuit which approximates the Hilbert transform is realized using only resistors, capacitors, and amplifiers and therefore can be produced in integrated circuit form. Dissert. Abstr.

N76-30440 Cornell Univ., Ithaca, N.Y.
ANALYTICAL AND COMPUTER-AIDED DESIGN TECHNIQUES FOR BIPOLAR AND FET TRANSISTOR AMPLIFIERS Ph.D. Thesis
Wendell Christian Petersen 1976 209 p
Avail: Univ. Mcrofilms Order No. 76-18183

Analytical and computer-aided design techniques for broadband high-frequency bipolar and FET transistor amplifiers are presented. Theoretical results on the optimum gain-band-width limitations are derived using equivalent circuits based on the measured scattering parameters of the transistor, with an arbitrary prescribed transistor gain roll-off characteristic. Optimum limits are derived for both the lumped and commensurate transmission-line distributed element cases, as well as a special case of lumped lossy matching networks. Several analytical design techniques are then presented to derive broadband matching networks which simultaneously provide (1) broadband matching to equalize the intrinsic reactive constraints, (2) broadband impedance transformation without transformers, and (3) compensation for the intrinsic transistor gain roll-off characteristic. Dissert. Abstr.

N76-30441 State Univ. of New York, Buffalo.
THE COMPLETE VERIFICATION OF DIGITAL SYSTEM COMPONENT DESIGNS Ph.D. Thesis
David Chester Sweeton 1976 170 p
Avail: Univ. Microfilms Order No. 76-17061

A procedure is presented for verifying that a given digital circuit design is correct. That is, given the logical function of each fundamental circuit component (gate or flip-flop) and the time delay characteristics of those components, the procedure determines whether or not a particular scheme for interconnecting the gates or flip-flops to form a combinational or sequential circuit defines a circuit which meets certain specified requirements. This method of verification has the advantage over the accepted method, which is simulation of the circuit, in that the new method produces complete verification as opposed to the verification of a sampling of the circuit functions. The verification is accomplished by modeling the given circuit as a mapping of circuit input information (both logical values and times of application) to the circuit output information. Dissert. Abstr.

N76-30442 Stanford Univ., Calif.
HIGH VOLTAGE DOUBLE DIFFUSED MOS TRANSISTORS FOR INTEGRATED CIRCUITS Ph.D. Thesis
Michael Donald Pocha 1976 269 p
Avail: Univ. Microfilms Order No. 76-18793

Monolithic silicon integrated circuits, including double diffused MOS (DMOS) switching devices with a breakdown voltage in excess of 200 volts and the capability of conducting 3 to 5 Megahertz singals with peak currents greater than 0.25 amps, were fabricated for use in a unique, high resolution, real time, three dimensional, ultrasonic imaging system (ULISYS) for medical diagnosis. An experimental and theoretical study is presented of the DMOS structure, examining the electrical parameters of importance in high voltage switching applications, relating these electrical parameters to processing, structural, and material parameters and discussing the optimization of device structure and processing to obtain desired electrical behavior.
Dissert. Abstr.

N76-30443*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MATRIX ANALYSIS OF LINEAR INDUCTION MACHINES Final Report, Sep. 1972 - Dec. 1974
David G. Elliott Sep. 1975 358 p refs Sponsored in part by NASA and FRA
(NASA-CR-148773; JPL-SP-43-24; FRA-ORD/D-75-77) Avail: NTIS HC $10.50 CSCL 09C

A matrix method for linear induction motors, single and double-sided, and linear induction liquid metal pumps and generators, flat and annular, was developed. The secondary is treated as a ladder mesh carrying unknown currents while the primary carries known currents. Matrices are calculated from the geometry, velocity, and frequency in order to set up a system of N equations in N unknowns that may be solved from the secondary currents by standard methods. The method incorporates accurate modelling of the magnetic field of the finite-length iron including the fields due to fringing, variable gap, slots, coils, and phase belts. The coils may have any arbitrary phase

connections. The drawbacks of the method are long computing times and the use of only a crude approximation to transverse edge effects by means of secondary impedance corrections from sheet-rotor motor theory. Author

N76-30444*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN AND PERFORMANCE EVALUATION OF SMALL, TWO- AND FOUR-STAGE DEPRESSED COLLECTORS FOR A 4.8 TO 9.6 GHz HIGH-PERFORMANCE TRAVELING WAVE TUBE Interim Report, Apr. 1975 - Jun. 1976
Peter Ramins, Henry G. Kosmahl, and Thomas A. Fox Aug. 1976 58 p refs Prepared in cooperation with Air Force Systems Command, Wright-Patterson AFB, Ohio
(NASA-TM-X-73486; E-8873) Avail: NTIS HC $4.50 CSCL 09A

A program to improve the efficiency of traveling wave tubes (TWT's) for use in electronic countermeasure (ECM) systems by applying multistage depressed collector (MDC) and spent beam refocusing techniques is studied. Three dimensional electron trajectories are computed through-out the slow wave structure of the TWT, the spent beam refocuser, and the depressed collector. Both TWT and MDC performances are analytically evaluated. Author

N76-30445*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ENVIRONMENTAL CHARGING OF SPACECRAFT SURFACES: TESTS OF THERMAL CONTROL MATERIALS FOR USE ON THE GLOBAL POSITIONING SYSTEM FLIGHT SPACE VEHICLE. PART 1: SPECIMENS 1 TO 5
N. John Stevens, Vernon W. Klinect, and Frank D. Berkopec Jul. 1976 42 p
(NASA-TM-X-73467; E-8836) Avail: NTIS HC $4.00 CSCL 09C

The NASA/USAF program on Environmental Charging of Spacecraft Surfaces consists of experimental efforts directed toward evaluating the response of materials to the environmental charged particle flux. Samples of thermal blankets and second surface mirrors of the type to be used on the Global Positioning System Flight Space Vehicle were tested to determine their response to electron flux. The primary result observed was that the ground connection of the metal layers of the blanket, as made by the baseline grounding technique using serrated washers and grommets, deteriorated with time at test. The discharges observed on the blankets were the glow type, not the 'lightning' strike observed on past specimens. Testing was performed at ambient laboratory temperatures. Author

N76-30446*# Ohio State Univ., Columbus. ElectroScience Lab.
SYSTEM IMPLICATIONS OF LARGE RADIOMETRIC ARRAY ANTENNAS Technical Report, 16 May 1974 - 30 Sep. 1975
C. A. Levis and H. C. Lin Jun. 1976 25 p refs
(Contract NAS5-20521)
(NASA-CR-144799; ESL-3931-2) Avail: NTIS HC $3.50 CSCL 09C

Current radiometric earth and atmospheric sensing systems in the centimeter wavelength range generally employ a directive antenna connected through a single terminal pair to a Dicke receiver. It is shown that this approach does not lend itself to systems with greatly increased spatial resolution. Signal to noise considerations relating to antenna efficiency force the introduction of active elements at the subarray level; thus, if Dicke switching is to be used, it must be distributed throughout the system. Some possible approaches are suggested. The introduction of active elements at the subarray level is found to ease the design constraints on time delay elements, necessary for bandwidth, and on multiple beam generation, required in order to achieve sufficient integration time with high resolution. Author

N76-30447*# General Electric Co., Philadelphia, Pa. Space Center.
ADAPTIVE MULTIBEAM ANTENNAS FOR SPACELAB. PHASE A: FEASIBILITY STUDY Final Report, 16 Jun. 1975 - 16 Feb. 1976
C. C. Allen, S. P. Applebaum, W. J. Popowsky, and G. Wouch Feb. 1976 156 p refs
(Contract NAS5-22425)
(NASA-CR-144803; Doc-76SDS4203) Avail: NTIS HC $6.75 CSCL 09C

The feasibility was studied of using adaptive multibeam multi-frequency antennas on the spacelab, and to define the experiment configuration and program plan needed for a demonstration to prove the concept. Three applications missions were selected, and requirements were defined for an L band communications experiment, an L band radiometer experiment, and a Ku band communications experiment. Reflector, passive lens, and phased array antenna systems were considered, and the Adaptive Multibeam Phased Array (AMPA) was chosen. Array configuration and beamforming network tradeoffs resulted in a single 3m x 3m L band array with 576 elements for high radiometer beam efficiency. Separate 0.4m x 0.4 m arrays are used to transmit and receive at Ku band with either 576 elements or thinned apertures. Each array has two independently steerable 5 deg beams, which are adaptively controlled. Author

N76-30448*# RCA Labs., Princeton, N.J.
DESIGN, PROCESSING, AND TESTING OF LSI ARRAYS FOR SPACE STATION Quarterly Technical Report, 1 Jan. - 31 Mar. 1976
A. C. Ipri Apr. 1976 26 p refs
(Contract NAS12-2207)
(NASA-CR-149981; PRRL-76-CR-17; QTR-20) Avail: NTIS HC $4.00 CSCL 09C

The work on the Process Analysis Structure was continued with the layout being completed, the 100X and 10X artwork being finalized, and the process and test sequences being prepared. Test programs were written for computer-controlled integrated-circuit testing and data reduction. Author

N76-30449# Radio Corp. of America, Burlington, Mass. Government Communications and Automated Systems Div.
PRODUCTION ENGINEERING MEASURES: AUTOMATIC ASSEMBLY OF HYBRID INTEGRATED CIRCUITS Quarterly Progress Report, 1 Feb. - 30 Apr. 1975
D. R. Bokil 29 Jul. 1975 39 p
(Contract DAAB05-73-C-2039)
(AD-A022198; QPR-5) Avail: NTIS CSCL 09/5

Effort has been initiated to develop automatic techniques and equipment capable of mass production of thick film hybrid integrated circuits. The CMOS amplifier HDL Drawing Number 11722540, used in the XM734 multi-option fuze, has been selected as the assembly which will serve as the test vehicle. Deliverables include 150 Engineering Samples, including the Test Fixtures, substrate relayout drawing, approximately 25 Pre-Demo Samples and 3,000 Pilot Run Units. Approval of the relayout and the Pre-Demo samples is to be obtained prior to proceeding with the Demonstration. The Pilot Run Units will be produced automatically per the Demonstration Plan, details of which were given in the Fourth Quarterly Progress Report. GRA

N76-30450# Naval Surface Weapons Center, White Oak, Md.
DESIGN OF A CMOS, FAST FOURIER TRANSFORM MODULE FOR DIGITAL SIGNAL PROCESSING APPLICATIONS Final Report, Jul. 1974 - Apr. 1975
Joseph Piekarski and Joseph R. Reid 18 Apr. 1975 115 p refs
(ZF61312001)
(AD-A022129; NSWC/WOL/TR-75-55) Avail: NTIS CSCL 09/5

A compatible set of digital signal processing modules was built for use in small, low-powered systems. This report describes the most complex of these, a Fast Fourier Transform (FFT) Module. This module was designed to be implemented in LSI. Towards this end a prototype CMOS, wire-wrapped system was built. This prototype FFT Module was incorporated in a sensor system to analyze real time acoustic signals. For this system the FFT module performed transforms on blocks of 512 sixteen bit real data words in 75 msec. It is capable of handling up to 4,096 complex or 8,192 real data words of up to any desired bit length. Author (GRA)

N76-30451# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Guidance and Control Directorate.

THERMAL ANALYSIS CONSIDERATIONS OF HYBRID MICROELECTRONIC CIRCUITS

Victor W. Ruwe and Tim D. Slagh Sep. 1975 70 p refs
(AD-A022256; RG-76-19) Avail: NTIS CSCL 09/5

This report presents the results of an analytical study of heat flow in hybrid microelectronic circuits and packages. The study is divided in two parts. First, heat removal from the package by convection and radiation is considered. Second, conduction of heat from an active chip area to a heat-sinked package header is modeled by use of finite-difference methods. Typical examples are worked to illustrate the analytical approach, and computer results of the finite-difference method are presented.
Author (GRA)

N76-30452# Siemens A.G., Munich (West Germany).

SENSORS FOR SOLID STATE CAMERAS WITH CHARGE COUPLED DEVICES AND BUCKET BRIGADE DEVICES Final Report [SENSOREN FUER FESTKOERPERKAMERAS MIT CHARGE COUPLED DEVICES AND BUCKET BRIGADE DEVICES]

Hans-Joerg Pfleiderer Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1975 80 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-75-49) Avail: NTIS HC $5.00; ZLDI, Munich DM 16.80

Basic circuits of charge transfer devices, especially of charge coupled devices (CCD), were investigated theoretically and experimentally. The object of the investigations, apart from basic circuit design, was the application of CCD's to optoelectronic sensors where a suitable synthesis between technology and design had to be found. A comparison is made with other possible elements such as bucket brigade devices and charge injection devices.
ESA

N76-30453# Danish Research Center for Applied Electronics, Hoersholm.

EVALUATION OF THE TECHNOLOGY OF SEMICONDUCTOR DEVICES. PART 2: PROCEDURE FOR METHODICAL FAILURE ANALYSIS AND DESCRIPTION OF TYPICAL FAILURES IN ENCAPSULATION, BONDING, METALLIZATION, PASSIVATIONLAYER AND BULK SILICON

E. Sletten and S. T. Olesen May 1975 81 p refs Sponsored by Sammenslutningen for Paalideligheds- og Miljoetek. and by Teknologiraadet
(ECR-51) Avail: NTIS HC $5.00

A systematic key to be used in connection with technological failure analysis in semiconductor components is presented. The systematic procedure described is to be used during a step by step sectioning and analysis where the principle is, that no part or layer must be destroyed before all information included in that part or layer is thoroughly noted and recorded, beginning with the outer surface of the component and finishing with microsectioning of the silicon chip itself. A list is given of typical failure mechanisms related to semiconductor components, regarding both encapsulation, bonding, metallization and glass failures as well as failures in the chip silicon structure itself. A bibliography covering the literature on which the work is based is included.
Author (ESA)

N76-30454# Danish Research Center for Applied Electronics, Hoersholm.

THICKFILM MULTILAYER TECHNIQUES. PRINTING PROBLEMS ENCOUNTERED WHEN MANUFACTURING THICKFILM MULTILAYER CIRCUITS [FLERLAGS TYKFILMTEKNIK. TRYKKEPROBLEMER VED FREMSTILLING AF MULTILAGSKREDSE I TYKFILMTEKNIK]

Karen Houlberg Jun. 1975 42 p In DANISH; ENGLISH summary Sponsored by Statens Teknisk-Videnskabelige Forskningsraad
(ECR-53) Avail: NTIS HC $4.00

The multilayer circuit printings are produced either by conservative cross-over technique, or by complementary printing technique using filled vias. The test pattern is constructed as a woven texture with conductor width ranging from 0.14 mm to 0.40 mm. Failure modes in the conductor- and dielectric layers are described and compared to measurements of conductor resistance, breakdown voltage, insulation resistance, and visual inspection of the test substrates. The yield as a function of the printing technique, the conductor width, the insulation layer thickness, and other parameters are evaluated. Profiles for some of the test substrates that clearly show the construction of the different multilayer printings are recorded by means of a surfometer. Various methods for manufacturing of thick film stencils and processing steps for the examined types of emulsions are included.
Author (ESA)

N76-30455# Helsinki Univ. of Technology, Otaniemi (Finland). Radio Lab.

EQUIVALENCE IN SENSITIVITY CALCULATION BETWEEN DIRECT DIFFERENTIATION AND THE METHOD BASED ON TELLEGEN'S THEOREM

Martti Valtonen 1976 9 p refs
(Rept-S-84; ISBN-951-750-637-6) Avail: NTIS HC $3.50

The concept of an adjoint network together with Tellegen's theorem was extensively used in deriving network sensitivity formulas both in analog circuits and digital filters. However, a direct differentiation of the network or signal-flow graph equations leads exactly to the same algorithm. The equivalence between the two methods is shown, and simultaneously the unnecessary complexity of the derivation of the sensitivity formulas, when using Tellegen's theorem and the adjoint network, is emphasized.
Author (ESA)

N76-30456# Helsinki Univ. of Technology, Otaniemi (Finland). Radio Lab.

MEASUREMENT OF NETWORK SENSITIVITIES USING VOLTAGE AND IMPEDANCE MEASUREMENTS

Martti Valtonen 1976 11 p refs
(Rept-S-85; ISBN-951-750-642-2) Avail: NTIS HC $3.50

A straightforward method is given for measuring transfer or driving point function sensitivities with respect to variable component values in reciprocal and nonreciprocal circuits. The proposed method is applicable for linear networks and also for nonlinear networks operating in linear region.
Author (ESA)

N76-30457# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

ORIENTING SILICON INTEGRATED CIRCUIT CHIPS FOR LEAD BONDING

Berthold K. P. Horn Jan. 1975 20 p refs
(Contract N00014-70-A-0362-0005)
(AD-A021137; AI-M-323) Avail: NTIS CSCL 13/8

Will computers that see and understand what they see revolutionize industry by automating the part orientation and part inspection processes. There are two obstacles: the expense of computing and our feeble understanding of images. The author believes these obstacles are fast ending. To illustrate what can be done he describes a working program that visually determines the position and orientation of silicon chips used in Integrated Circuits.
GRA

N76-30458# University of Southern Calif., Los Angeles. Electronic Sciences Lab.

MICROWAVE FREQUENCY SURFACE WAVE DELAY LINES AND AMPLIFIERS WAVE PROPAGATION AND MATERIALS STUDY Final Report, 1 Feb. 1971 - 31 Jun. 1975

K. M. Lakin, D. Penunuri, and J. K. Liu Mar. 1976 303 p refs
(Contract N00014-67-A-0269-0018)
(AD-A021922; USCEE-489) Avail: NTIS CSCL 09/1

This report details the research done on a four-year project involving the study of surface wave propagation and the growth and characterization of thin film materials as applied to microwave frequency surface acoustic wave delay lines and amplifiers. The report covers the two phases of the work separately in the form of a brief review of each topic referring to details contained in appendices. The report presents the complete details of the layered and leaky wave study along with the FORTRAN object listings of the major computer programs used in the study. The report presents the materials work in the form of reprints of published papers covering the topics of the growth and characterization of AlN/Al2O3 and Si/AlN/Al2O3. A brief discussion is given of other material combinations that were examined briefly and then abandoned in favor of more promising

approaches. The report does not discuss devices such as delay line filters or amplifiers except as used to evaluate materials through coupling coefficient measurements or verification of acoustoelectric interactions. Author (GRA)

N76-30459# Reliability Analysis Center, Griffiss AFB, N.Y.
MICROCIRCUIT DEVICE RELIABILITY: MEMORY/LSI DATA
Henry C. Rickers 1976 214 p refs
(Contract F30602-73-C-0065)
(AD-A023227; RAC-MDR-3) Avail: NTIS CSCL 09/5

The compendium of Microcircuit Reliability data is separated into two parts: General LSI Technology Summaries and Detailed Data Sections. The first part presents descriptions of the fabrication processes of the LSI technologies, characterization of parameters which influence device reliability, and general data summaries. The second part is arranged with each section devoted to a particular Memory/LSI device function. Each section in part two contains a detailed breakdown of part level life and environmental/screening test results arranged by part manufacturer and part number. In addition, each section contains data summaries which provide quick insight into life test results, reliability demonstration test results, and failure classifications. GRA

N76-30460# United Technologies Research Center, East Hartford, Conn.
SPUTTERED THIN FILM RESEARCH Final Report, 15 Apr. 1972 - 31 Jan. 1976
A. J. Shuskus Feb. 1976 60 p refs
(Contract N00014-72-C-0415; ARPA Order 2173)
(AD-A022385; UTRC/R76-921337-19) Avail: NTIS CSCL 09/1

This report discusses the results of an investigation regarding the potential of the high dielectric constant materials SrTiO3, WO3 and HfO2 as alternate gate insulators for radiation hardened insulated gate field effect transistors. The insulators were deposited by rf sputtering. Capacitor structure fabricated with SrTiO3 and WO3 films did not show adequate stability under bias and temperature stress to be useful gate dielectrics. Reactively sputtered hafnium dioxide MIS capacitors exhibited far more stable characteristics with bias and temperature stress, although slow trapping effects were observed at high bias voltages. Hafnium dioxide MIS capacitors irradiated with Co(60) gamma rays to a dose of 10 to the 7th power rads showed a high degree of radiation tolerance. Based on these encouraging results, n-channel and p-channel transistors with hafnium dioxide gate insulators were fabricated. GRA

N76-30461# Allis-Chalmers Corp., Pittsburgh, Pa.
DISTRIBUTION TRANSFORMER TANK PRESSURE STUDY Final Report
E. A. Goodman Feb. 1976 67 p refs
(PB-251258/0; EPRI-325-FR) Avail: NTIS HC $4.50 CSCL 09A

Calculated static pressures are given which may occur within faulted oil filled distribution transformers as a result of arcing and gas generation. Information contained in this report is the result of extensive mathematical study of distribution transformer internal pressure of relatively slow build-up. Even though impact type forces are not considered, the pressure tables can be useful in the design of distribution transformer enclosures. It can be applied by transformer users in reaching a decision to retrofit existing transformers with automatic pressure relief devices, or to modify fusing practices for distribution transformers. GRA

N76-30462# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.
A PRECISION 30 MHz WAVEGUIDE-BELOW-CUTOFF ATTENUATOR WITH AN ABSOLUTE ELECTRONIC READ-OUT, NBS MODEL X11 Final Report
Robert T. Adair Jan. 1976 50 p refs
(PB-250846/3; NBSIR-76-833) Avail: NTIS HC $4.00 CSCL 09A

A coaxial precision waveguide-below-cutoff attenuator is described which uses an absolute (unambiguous) electronic digital readout of displacement in decibels instead of the usual gear-driven mechanical counter/dial readout in decibels. The attenuator has a fixed-position RF input connector and a movable RF output connector. The attenuation rate for 30 MHz operation is given along with a discussion of sources of errors. In addition, information is included to aid the user in making adjustments on the attenuator should it be damaged or disassembled for any reason. GRA

N76-30463# National Bureau of Standards, Washington, D.C. Electronic Technology Div.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY: ARPA/NBS WORKSHOP 4: SURFACE ANALYSIS FOR SILICON DEVICES Final Report
A. George Lieberman Mar. 1976 241 p refs Workshop held at Washington, D. C., 23-24 Apr. 1975
(ARPA Order 2397)
(PB-251349/7; NBS-SP-400-23; LC-76-608043) Avail: NTIS HC $8.00 CSCL 09A

The workshop, as part of an NBS program to develop measurement technology for the field of semiconductor devices, was held to discuss the present capabilities and future prospects of modern analytical beam techniques as applied to silicon, and associated insulator films and device structures. Of particular interest were the determination of impurity profiles, surface contamination, and interface characteristics. Techniques using impinging electron, ion, neutral, or photon beams were considered. The workshop was directed at the analysts, the semiconductor manufacturers who use the analysts' results, and the instrument people who design and manufacture the analytical equipment. GRA

N76-30464# Martin Marietta Aerospace, Orlando, Fla.
PWB PRODUCTION ASSEMBLY COST GUIDELINES Final Quarterly Progress Report, 1 Aug. - 31 Dec. 1975
Sol C. Osborne, Wendell R. Hutchinson, and Frederick E. Tartaglia Dec. 1975 105 p
(Contract DAAB07-75-C-0029)
(AD-A020960; OR-13826-1) Avail: NTIS CSCL 13/8

Work is continuing on the preparation of the PWB Production Assembly Cost Guidelines Manual to provide guidelines to enable users to select and evaluate manual and automatic assembly methods. The section on assembly techniques has been completed. This includes description of assembly procedures, manual working to drawings, to visual aids, and manual to programmed assembly equipment, NCI. Also included are computer/NC tape controlled machines used separately and as part of a machine assembly system. Equipment specifications have been formulated, two of which are included in this Quarterly Report. Also, standard performance time tables have been expanded and put into final form. Assembly cost analysis, though completed and reported in the first quaterly report, has been further simplified as part of the cost forms section. Improved forms have been included because of their close relationship with this section for review and comment. Design for automation analysis, not previously reported, is included in its entirety in its near completed state to permit a comprehensive overview. Design for automation is presented in network format from original circuit design and component selection to basic board artwork, to packaging, and to final assembly. GRA

N76-30465# Sprague Electric Co., North Adams, Mass.
DEVELOPMENT AND FABRICATION OF 1000 Hz RC OSCILLATOR Final Report
S. T. Churchill 31 Jan. 1968 70 p
(Contract DA-49-186-AMC-49(A); SEC Proj. A119-04)
(AD-A020860; HDL-49-4) Avail: NTIS CSCL 14/2

Work was performed toward developing an oscillator for use as a timing reference in ordnance applications. This oscillator requires a frequency stability of 1000 Hz plus or minus 0.05% over the operating temperature range of -55C to +75C. In addition, the device must have a ten-year life frequency stability of plus or minus 0.05%. GRA

N76-30466# TRW Systems Group, Redondo Beach, Calif.
PFN CHARACTERIZATION AND LIFE TEST Final Report, Oct. 1974 - Aug. 1975
C. L. Dailey and C. W. White Jan. 1976 50 p refs
(Contract F33615-75-C-2003; AF Proj. 3145)
(AD-A022958; AFAPL-TR-75-69) Avail: NTIS CSCL 09/5

The feasibility of an integral, high temperature, pulse forming

network (PFN) operating at a high pulse rate for a short duration burst has been demonstrated. The dielectric construction of the capacitors consisted of Kapton film and paper impregnated with Monsanto Chemical Co. MS 1489 oil. Litz wire coils were wound on a high temperature foam core, and the entire assembly was placed in a stainless steel enclosure. A U-shaped aluminum shield was used between the coils and the case to reduce eddy current heating. An overall weight of approximately 20 pounds for an energy storage density of 600 joules (30 joules per pound) was achieved in a design that operated for 150,000 shots at a pulse rate of 280 shots per second in 18 second bursts. The burst duration was limited by heating of the stainless steel enclosure due to eddy currents induced by the coil magnetic field. An aluminum case construction would greatly reduce this effect.
Author (GRA)

N76-30467# National Bureau of Standards, Washington, D.C. Mechanics Div.
NBS PROGRAM IN PHOTOMASK LINEWIDTH MEASUREMENTS Final Report
Dennis A. Swyt Apr. 1976 8 p refs Repr. from Solid State Technol., vol 19, no. 4, Apr. 1976 p 55-61
(ARPA Order 2397)
(PB-252445/2) Avail: NTIS HC $3.50 CSCL 14B

The status of a program to develop standards and to develop the means to identify and control the parameters of optical system performance which introduce errors into linewidth measurements is discussed. GRA

N76-30468# Naval Civil Engineering Lab., Port Hueneme, Calif.
STRESS CONCENTRATION FACTOR DETERMINATION IN STATION POST INSULATOR Final Report, Apr. - Jun. 1975
D. T. Corrente Feb. 1976 20 p refs
(YF53534011)
(AD-A022458; CEL-TN-1427) Avail: NTiS CSCL 09/1

A computer model of a station post insulator was analyzed for stress concentration with a finite element program for an applied stress of 1,000 psi. A stress concentration factor of 2.01 was obtained for the vertical stress between the sheds; this corresponded to a strain of 195 microinch/in. The prototype, which was strain-gaged and loaded, yielded a strain value of 200 microinch/in. Other computer information obtained were the shear, radial, and circumferential stresses and strains throughout the entire station post insulator. Author (GRA)

N76-30469# Defence Research Establishment Ottawa (Ontario).
LATEX-BOUND LEAD CHLORIDE CATHODES
John R. Coleman 11 Jan. 1976 26 p refs
(AD-A021308; DREO-TN-75-30) Avail: NTIS CSCL 09/1

Cathodes were made from lead chloride mixed with a conductive carbon (graphite, preferably with small additions of Shawinigan black). These dry mixes were blended with various synthetic rubber latexes in aqueous suspension, spread on an expanded metal grid, dried, and ultimately compressed to form the cathode. Of 16 latexes examined, UCAR 891 proved particularly suitable. Cathodes so made were assembled with magnesium alloy anodes to form single cells and discharged in dilute saline solutions. Discharge conditions were comparable to those for batteries used in the operation of passive sonobuoys. Performance resembled that of lead chloride cathodes made in other ways except at the low temperature low salinity extreme (0C, 1.5% NaC1) where low run voltages and slow rise to working voltage were observed. This problem must be overcome before application in sea water batteries can be considered.
Author (GRA)

N76-30470# Illinois Univ., Urbana Coordinated Science Lab.
GENERAL DESIGN RULES FOR THE CONSTRUCTION OF M-OUT-OF-N TOTALLY SELF-CHECKING CHECKERS
James E. Smith and Gernot Metze Oct. 1975 32 p refs
(Contract DAAB07-72-C-0259)
(AD-A021675; R-693; UILU-ENG-75-2228) Avail: NTIS CSCL 09/2

This report presents a set of conditions sufficient to characterize a class of realizations of m-out-of-n code totally self-checking checkers. The same conditions are shown to be necessary for the construction of two-level checkers and a design method for minimal two-level checkers is given. Using a well known theorem from combinatoric, a relationship which must exist between m and n in order for the above mentioned conditions to be satisfied is shown. GRA

N76-30471# Watkins-Johnson Co., Palo Alto, Calif.
ELECTRON BEAM SEMICONDUCTOR S-BAND AMPLIFIER Final Report, 1 Jun. 1974 - 31 Aug. 1975
Lester A. Roberts Jan. 1976 40 p
(Contract DAAB07-72-C-0220; DA Proj. 1S7-62705-AH-94) (AD-A021699; W-J-4102-R7; ECOM-72-0220-F) Avail: NTIS CSCL 09/1

This report discusses results of an investigation leading to the development of a pulsed 1 kilowatt peak power (EBS) RF amplifier operating at 3.2 GHz. The feasibility of building pulsed power (EBS) amplifiers in the 3 GHz frequency range was demonstrated. Techniques have been worked out for designing and constructing semiconductor diodes capable of maintaining their electrical characteristics under high voltage beam bombardment and high peak current conditions. A resonator and coupling system for S- Band operation has been devised which provides the proper diode load impedance and RF output coupling to a 50 ohm transmission line. The meanderline deflection structure has been improved so that a 1 watt RF input signal is sufficient to provide full beam deflection for optimum diode current modulation. Author (GRA)

N76-30472# National Bureau of Standards, Washington, D.C. Building Environment Div.
SURVEY OF GROUND FAULT CIRCUIT INTERRUPTER USAGE FOR PROTECTION AGAINST HAZARDOUS SHOCK Final Building Sciences Series Report
Robert W. Beausoliel and William J. Meese Mar. 1976 22 p refs
(PB-251416/4; NBS-BSS-81; LC-76-608069) Avail: NTIS HC $3.50 CSCL 13L

The ground fault circuit interrupter (GFCI) is increasingly becoming an integral part of building electrical systems to protect human life. Building researchers, designers, and contractors should have a working knowledge of their purpose and operational characteristics. The functional principles of GFCIs are described and their performance is related to effects of electric current on the human body. Information concerning the history, research and testing, installation practices, fire protection aspects, types, manufacturers and costs of GFCIs are included. The trend of requiring installation of GFCIs on more and more electrical circuits by regulatory authorities for safety purposes is outlined. Controversies concerning feasibility, reliability, nuisance tripping and other problems are discussed. GRA

N76-30473# National Bureau of Standards, Washington, D.C. Electronic Technology Div.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY Interim Progress Report, 1 Jan. - 30 Jun. 1975
W. Murray Bullis Apr. 1976 98 p refs Sponsored in part by Defense Nuclear Agency, Washington, D. C. and Navy Strategic Systems Proj. Office, Washington, D. C.
(ARPA Order 2397)
(PB-251844/7; NBS-SP-400-19) Avail: NTIS HC $5.00 CSCL 14B

Principal accomplishments during this reporting period included: (1) completion and analysis of an interlaboratory evaluation of standard reference wafers for resistivity measurement by the four-probe method; (2) analysis of the effect of finite contact size on sheet resistance as measured with a van der Pauw structure; (3) calculation of errors introduced in measuring line width with typical microscope systems; (4) development of procedures for predicting the magnitude of electron beam induced current in silicon device structures; (5) application of the optical flying-spot scanner to observation of hot spots and nonlinearities in UHF power transistors and of logic patterns in an MOS shift register; and (6) determination of a more accurate electrical method, based on peak junction temperature measurement. GRA

N76-30474# Hughes Aircraft Co., Torrance, Calif. Electron Dynamics Div.
PRODUCTION ENGINEERING MEASURES SOLID STATE

MICROWAVE OSCILLATORS FOR FUZES Quarterly Progress Report, 1 Aug. - 1 Nov. 1975
H. C. Bowers, W. R. Lane, W. H. Lockyear, and C. O. G. Obah Dec. 1975 29 p
(Contract DAAB05-73-C-2070)
(AD-A022093; EDD-W-40376-10; QPR-10) Avail: NTIS CSCL 09/1

Work performed toward establishing a manufacturing capability for TRAPATT oscillators is described. The final design of the diodes for this program has been achieved. Improvements in the yield of TRAPATT diodes both in processing and RF testing is discussed. Comparative data on the RF performance of the two UHF microstrip circuits is presented, and minor improvements in the S-band coaxial circuit are discussed. Improvements in the modulators are discussed. GRA

N76-30475# Syracuse Univ., N.Y. Dept. of Electrical and Computer Engineering.
A COMPARISON OF OPTIMIZATION TECHNIQUES AS APPLIED TO GAIN OPTIMIZATION OF A REACTIVELY LOADED LINEAR ARRAY
John Luzwick and Roger F. Harrington Feb. 1976 39 p refs
(Contract N00014-76-C-0225)
(AD-A022155; TR-1; TR-76-2) Avail: NTIS CSCL 09/5

The use of reactance loads is considered to maximize the end-fire gain of a linear array of N half wavelength thin parallel wire dipoles reactively loaded at their centers with only one element externally driven. The use of one feed element eliminated the need for complex transmission line feed networks normally associated with linear arrays. The overall gain realized was between the maximum value obtained by all the elements externally driven with the proper complex currents and the maximum gain obtained using the reactive loads which resonate the real port currents for maximum gain. Four numerical optimization techniques, Univariate, Rosenbrock, DFP (Davidon-Fletcher-Powell), and Continued Partan, were tried, and their results as far as correctness and efficiency were tabulated for this class of functions. These four techniques are representative of all currently available numerical optimization methods. For this report, arrays of N = 4, 7, and 10 elements were considered. Author

N76-30476# Microwave Associates, Inc., Watsonville, Calif. Relmag Div.
PRODUCT IMPROVEMENT PROGRAM COAXIAL MAGNETRON FOR AN/MPQ-4A RADAR SET Final Report, 15 Jul. 1973 - 15 Jul. 1975
David Blank Sep. 1975 67 p
(Contract DAAB07-73-C-0315)
(AD-A022108; ECOM-73-0315-F) Avail: NTIS CSCL 09/1

Magnetrons were designed and manufactured to the same parameters described in the original proposal submitted in April 1973. Ten of these tubes were passed through acceptance tests and delivered to ECOM. The remaining five tubes were run through qualification tests and two of these five tubes were run on life test for 1,000 hours each before submission to ECOM. Performance data is given for all tubes and qualification data for the five tubes. An analysis of tube failures during the program is included. GRA

N76-30477# National Bureau of Standards, Washington, D.C. Electronic Technology Div.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY: DEFECTS IN p-n JUNCTIONS AND MOS CAPACITORS OBSERVED USING THERMALLY STIMULATED CURRENT AND CAPACITANCE MEASUREMENTS
Martin G. Buehler Apr. 1976 22 p refs
(ARPA Order 2397)
(PB-251911/4; NBS-SP-400-26; LC-76-608059) Avail: NTIS HC $3.50 CSCL 20L

The reported methods involve thermally stimulated capacitance and current measurements which utilze the ability of defects in the vicinity of a p-n junction or in an MOS capacitor to trap holes or electrons and emit them after receiving sufficient thermal energy. Values for defect densities, energy levels, and emission rates can be derived from these measurements. These values provide sufficient information to positively identify the defects. Three vehicles are used to illustrate the methods: a gold doped n(+)-p diode, a p(+)-n diode with a process induced defect center, and a gold doped n-type MOS capacitor. Two cryostats are described which have a maximum heating rate of 10k/s. GRA

N76-30478# Texas Instruments, Inc., Dallas. Central Research Labs.
TUNABLE FILTERS USING CHARGE TRANSFER DEVICES Final Report, 16 Jul. 1974 - 15 Dec. 1975
D. D. Buss and C. R. Hewes Mar. 1976 57 p refs
(Contract DAAB07-73-C-0266; DA Proj. 1S7-62705-AH-94)
(AD-A022065; TI-08-75-43; ECOM-73-0266-F) Avail: NTIS CSCL 09/5

To date, CCDs have required complicated off-chip peripheral circuitry. The widespread application of CCDs to transversal filtering in systems depends on the integration of these circuits on the CCD chip. This report describes the design and performance of a completely self-contained and integrated 800-stage CCD transversal filter. The device contains the clock generator and drivers as well as the input and output circuits, so that only dc voltages and one master clock signal are required to operate the device. The chip is designed for general filtering applications and can be mask-programmed for a variety of different transfer functions. Its performance as a tunable bandpass filter with a 3 db bandwidth of 0.7% of the center frequency and 40 db sidelobe rejection is described. The center of the passband can be tuned from 500 Hz to 500 kHz. Key problems in the integration of the peripheral circuits have been related to the use of standard MOS circuits to perform these functions. To solve these problems, we have designed voltage amplifiers on this device. A CCD type of structure is used to obtain a differential sampled data voltage amplifier. These amplifiers are used both for the input stage and for the differential output of the filter. These amplifiers provide significant advantages over standard MOS circuits including good linearity, high speed, low power, low noise, and stable gain performance. Experimental results obtained with the bandpass filter are compared to predicted performance. Author (GRA)

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N76-30479 Clarkson Coll. of Technology, Potsdam, N.Y.
THERMAL CONVECTION IN THE LIQUID FILM OF A STRATIFIED GAS/LIQUID FLOW Ph.D. Thesis
Chang Kyun Choi 1976 164 p
Avail: Univ. Microfilms Order No. 76-18848

Thermal convection in the liquid layer of a stratified two-phase gas/liquid horizontal flow was investigated. The onset of natural convection in a thin smooth film of water flowing due to the adjacent air stream was analyzed using linear stability theory. Considering the primary flow as plane Couette flow, the stability of the longitudinal roll mode was investigated for a primary temperature that was taken to be nonlinear because of the developing temperature profile encountered. Over-all heat transfer characteristics were obtained from direct measurements of local Nusselt numbers together with flow visualization techniques using a dye and Rheoscopic Fluid AQ 1000' as tracers. In the experimental ranges of $50 < Re < 450$, $3 < Pr < 7$ and $1500 < Ra$ 400,000 the first discernable perturbance motion was a straight longitudinal roll, and the characteristics of these roll patterns depended on the Rayleigh number. Dissert. Abstr.

N76-30480 Texas A&M Univ., College Station.
DISTRIBUTION OF NON-BUOYANT MATERIAL FROM A CONTINUOUS SOURCE IN SHEAR FLOW: A SIMILARITY APPROACH Ph.D. Thesis
Richard David deBruin 1975 113 p
Avail: Univ. Microfilms Order No. 76-17351

An approximate method of solution to the problem of the dispersal of a neutrally buoyant material in a shear flow regime is sought by use of a similarity approach involving a finite number

of parameters which characterize the distribution of material at a given distance from the source. Equations governing these parameters are obtained from appropriate integral moments of the basic equation governing the advection and diffusion of the material. The parameters include those characterizing the concentration of material along the core of the resulting plume, the standard deviation of the concentration profile in the lateral directions, and the position of the core of the plume. The method is applied to cases with known exact analytical solutions as a verification of the procedure. It is then applied to cases of a continuous source in a shear flow for which analytical solutions do not exist, using appropriate numerical methods.
Dissert. Abstr.

N76-30481 Michigan Univ., Ann Arbor.
INSTABILITY OF STEADY AND OF TIME-PERIODIC NATURAL CONVECTION IN A STRATIFIED FLUID Ph.D. Thesis
Robert Frederick Bergholz, Jr. 1976 117 p
Avail: Univ. Microfilms Order No. 76-19083

The stable density stratification is produced by a uniform vertical temperature gradient along each of two vertical, parallel planes which bound the fluid laterally. In the steady problem, the primary flow is generated by a fixed temperature difference between the planes whereas, in the time-periodic case, this temperature difference is assumed to be purely a sinusoidal function of time. The analysis is based upon the linear stability theory of parallel flows. High-order approximate solutions of the two-dimensional, linearized disturbance equations are obtained by Galerkin's method in conjunction with the technique of expanding the disturbance variables in series of orthonormal base functions. The Floquet theory for ordinary differential equations with periodic coefficients also is used to establish the stability criterion for the time-periodic flow. Dissert. Abstr.

N76-30482 Brandeis Univ., Waltham, Mass.
PROJECTION OPERATOR TECHNIQUES IN THE CLASSICAL KINETIC THEORY OF FLUIDS Ph.D. Thesis
Michael Joseph Lindenfeld 1976 119 p
Avail: Univ. Microfilms Order No. 76-16926

The projection operator techniques of Mori and Zwanzig are applied to simple classical fluids. A general operator formalism is used to express the orthogonal resolvent operator memory function as correlations containing the usual Koopman resolvent operator. From this, an infinite chain of non-Markoffian equations is readily derived, starting with the singlet distribution, the first two of which are the basis of Mazenko's fully renormalized kinetic theory. The abstract formalism allows comparisons, discussions and extensions of various theories. Dissert. Abstr.

N76-30483 Tennessee Univ., Knoxville.
NOISE AND FLOW CHARACTERISTIC OF LINEAR ARRAYS OF CIRCULAR JETS AND EJECTOR FLOW SYSTEMS Ph.D. Thesis
Ingo Udo Borchers 1976 287 p
Avail: Univ. Microfilms Order No. 76-17717

Sound power and directivity measurements on linear arrays of two to five circular model jets with equal exit diameter and different center spacings are represented. The flow field of two adjacent jets is investigated by means of hot-film measurements and shadowgraphs. In addition, an experimental study on the sound power reduction and thrust performance of a two-nozzle ejector system with and without acoustic liners is described, and the results of a one-dimensional ejector analysis are reported. Dissert. Abstr.

N76-30484 State Univ. of New York, Stony Brook.
AN EXPERIMENTAL INVESTIGATION OF A HEATED TURBULENT ROUND JET Ph.D. Thesis
Narinder Kumar Tutu 1976 189 p
Avail: Univ. Microfilms Order No. 76-18726

A simple analog technique of obtaining continuous and simultaneous signals for velocity and temperature in nonisothermal turbulent flows is presented. An analysis of the response of an X-probe which takes into account the axial sensitivity k, the effect of w component of velocity and the effective rectification by the hot wire is given. Owing to rectification points in the measured u, v 'phase plane' are confined within a certain sector, thus leading to distortions in the measured joint probability density functions. Temperature and velocity fields in a round heated jet were investigated in detail. Filtered correlation measurements show that large scale turbulent motions are responsible for the bulk of momentum and heat transport, and also that small scales are more efficient in transporting heat than momentum. Experimental results are discussed in detail, particularly with regard to the entrainment. Conservation equations were derived and modelling of some of the resulting higher order correlations is suggested. Dissert. Abstr.

N76-30485 Washington Univ., Seattle.
SHOCK-INDUCED SEPARATION OF A TURBULENT BOUNDARY LAYER Ph.D. Thesis
Richard Jude Page 1975 186 p
Avail: Univ. Microfilms Order No. 76-17583

An experimental investigation concerning the shock wave induced separation of a turbulent boundary layer was conducted There were two main phases to the investigation. Firstly, to thoroughly define the boundary layer upstream of the interaction with the shock wave. Secondly, to measure the shock wave strength required for incipient separation as defined in a number of different ways, and to distinguish between strict sense separation, i.e., the first occurrence of reversed flow, and effective separation, i.e., the first appearance of significant changes in the flow field caused by reversed flow in the boundary layer.
Dissert. Abstr.

N76-30486 Pennsylvania State Univ., University Park.
AN ANALYSIS OF LAMINAR PROPORTIONAL AMPLIFIERS Ph.D. Thesis
Gary Vernon Smith 1975 273 p
Avail: Univ. Microfilms Order No. 76-17224

An analytical and experimental analysis of pressure-controlled jet-deflection amplifiers which operate with supply jets in the laminar flow regime is described. The results of flow visualization studies of large-scale working models of laminar proportional amplifiers are discussed. A suitable operating Reynolds number range, limited by transition to turbulence and excessive jet spreading, of 700 to 1,400 is suggested. A mathematical model is presented for the prediction of the operating characteristics of the laminar amplifier. A lumped parameter model approach is chosen so that the effects of operating conditions and geometry could be easily determined. The resulting flow equations are linearized for the determination of the static operating characteristics. Dissert. Abstr.

N76-30487 Washington Univ., Seattle.
THE EFFECT OF SURFACE ACTIVE AGENTS ON MASS TRANSFER IN AGITATED GAS-LIQUID DISPERSIONS Ph.D. Thesis
Brij Bhooshan Maini 1976 139 p
Avail: Univ. Microfilms Order No. 76-17551

The transfer of oxygen from air bubbles to water, in presence of surface active agents, was investigated in a turbine agitated aeration vessel. The variables studied were the concentration of the surfactants, stirring speed, and air flow rate. Four mass transfer parameters of the aeration process were measured independently. The product of the mass transfer coefficient and the interfacial area was evaluated from the unsteady state variation in oxygen concentration as measured by a polarographic oxygen probe. The interfacial area was measured by a light obscuration method. An electrical level sensing device was used for the measurement of holdup. The power dissipation was measured by strain gages attached to the shaft of the turbine impeller. Four members of the homologous series of sodium alkyl sulfates and Dow Corning Antifoam C were studied in the concentration range of 0.002 to 20 ppm. Dissert. Abstr.

N76-30488 Ohio State Univ., Columbus.
STEREOSCOPIC VISUAL STUDY OF A TURBULENT SHEAR FLOW Ph.D. Thesis
Ananda Kumar Praturi 1976 165 p
Avail: Univ. Microfilms Order No. 76-18023

A stereoscopic visual study of a turbulent boundary layer flow was conducted. A stereoscopic system was developed to photograph the motions of tracer particles in three dimensions. The experimental technique consisted of recording the tracer

particles motions with a stereoscopic camera that moved with the flow. The emphasis was on qualitative observations of individual motions and events in three dimensions, occurring in the entire flow field. Dye injection at the leading edge of the flat plate helped delineate the turbulent, nonturbulent regions of the flow. The boundary layer flow was found to exhibit three characteristic regions: (1) wall region, (2) outer region and (3) irrotational region. The wall and outer regions were highly turbulent in character (rotational motions, velocity fluctuations, etc.), while motions in the irrotational region were linear and laminar-like. The most significant result is the close association of coherent events occurring in the entire flow. Dissert. Abstr.

N76-30489 New Brunswick Univ., Fredericton.
MIXING AND FLOW PATTERNS IN AN ISOTHERMAL, TURBULENT, CONFINED, SWIRLING JET SYSTEM Ph.D. Thesis
Kannan Nagarajan Tennankore 1975 190 p
Avail: Univ. Microfilms Order No. 76-17673

Experimental investigations were carried out to determine the mixing and flow patterns in a confined, isothermal, swirling jet system over a range of operating conditions in terms of graft determines the reaction rate at high flow rate. The experimental data were compared with the theoretical solutions and it was seen that at low flow velocities the experimental reaction rates agreed with the theoretically predicted rates. At high flow rate the reaction rate is independent of flow rate. Under these conditions, it was found that the reaction rate is virtually determined by the kinetics of enzyme reaction, the internal diffusion resistance being relatively unimportant. The storage stability of the immobilized CT films and the operational life of the immobilized CT tubular reactor were also studied. It was seen that immobilized CT retained its activity over considerably longer periods than did free CT when stored at pH 7.8 and 25 deg. Dissert. Abstr.

N76-30490 Washington Univ., Seattle.
MASS TRANSFER FROM A SLIGHTLY SOLUBLE GAS BUBBLE IN TURBULENT FLOW Ph.D. Thesis
Hiroshi Sawa 1975 141 p
Avail: Univ. Microfilms Order No. 76-17611

A cinematographic arrangement was used to measure the shape of a bubble more accurately. The method provided the synchronized images of a bubble from two adjacent sides of the channel on the same frame of the photograph. The size of the bubble was determined from the analysis of both images. There was a small scattering of data at each original data point, but the time average values from 10 to 20 points were quite smooth without using smoothing procedures. The mass transfer coefficients were measured for CO2, O2, N2, H2, and He systems in water for an equivalent diameter range from 0.07 cm to 0.4 cm. The diffusivity dependence of the mass transfer coefficient was clearly observed. The results agreed with the 1/2 power dependence of the penetration model for circulating bubbles in turbulent flow. Higher dependence was observed for small bubble in a laminar continuous phase. Dissert. Abstr.

N76-30491 Tennessee Univ., Chattanooga.
FLOW OF POLYMER FLUIDS INTO CONE AND CONVERGING PLATES Ph.D. Thesis
Akio Kondo 1976 179 p
Avail: Univ. Microfilms Order No. 76-17728

The flow of polymer fluids into a cone and between converging plates was studied both theoretically and experimentally. Flow patterns of viscoelastic fluids into a cone and converging plates were calculated by a perturbation procedure, adopting the second and third order fluid models. In both cases, a secondary circulating flow was predicted and the ratio of coefficients of the third order fluid was found to dominate the flow patterns. The laminar flow patterns were studied in a capillary die for nine low density polyethylenes, one high density polyethylene and nine polystyrenes, all of which were well characterized rheologically. The end pressure drops were measured. The dependence of the flow patterns on geometry angle was studied in a wedge type die. Flow patterns into complex dies were also observed. Many attempts were made to correlate the theoretical predictions and the experimental results. The most useful correlating group involves the ratio of the first normal stress difference to the shear stress. Dissert. Abstr.

N76-30492 Stanford Univ., Calif.
MOMENTUM AND ENERGY TRANSPORT IN THE ACCELERATED FULLY ROUGH TURBULENT BOUNDARY LAYER Ph.D. Thesis
Hugh Wayne Coleman 1976 165 p
Avail: Univ. Microfilms Order No. 76-18756

The behavior of the fully rough turbulent boundary layer subjected to favorable pressure gradients was investigated experimentally using a porous test surface composed of densely packed spheres of uniform size. Measurements of profiles of mean velocity, mean temperature and the components of the Reynolds stress tensor are reported for both unblown and blown layers. Stanton numbers were determined from energy balances on the test surface and skin friction coefficients from measurements of the Reynolds shear stress and mean velocity.
Dissert. Abstr.

N76-30493 Texas A&M Univ., College Station.
BLADE LOADING ANALYSIS OF A CENTRIFUGAL IMPELLER USING VISCOUS EFFECTS Ph.D. Thesis
Yadiyurappa Siddaveerasetty Bale 1975 64 p
Avail: Univ. Microfilms Order No. 76-17339

The blade loading analysis of a centrifugal impeller using viscous effects is presented. The only major assumption is that the flow is steady. A quasi-three dimensional solution is used to solve the momentum and energy equations in the hub-to-shroud and blade-to-blade planes to obtain the blade loading in a centrifugal impeller. This approach has been traditional and gives analytically a three-dimensional picture of the flow in a centrifugal impeller. A detailed numerical procedure and a flow chart are given for use on a computer. Dissert. Abstr.

N76-30494 North Carolina State Univ., Raleigh.
A NUMERICAL STUDY OF FREE CONVECTIVE HEAT TRANSFER Ph.D. Thesis
Shen-Tong Lew 1972 193 p
Avail: Univ. Microfilms Order No. 76-17248

Two internal free convective time dependent flow problems were investigated by integrating numerically the governing Navier-Stokes and energy equations. Problem 1 concerned the flow between a rectangular hot plate of finite thickness and its enclosing cavity, while Problem 2 dealt with the flow about a hot stripe embedded along the wall of its enclosing cavity. Arbitrary orientation was assumed in the latter problem and the flow was assumed to be caused by the instantaneous heating of the plates. The governing equations were cast in a form which was free of the pressure term and then discretized according to four different finite-difference schemes. Both explicit and implicit schemes were studied. A stability criterion was established for the explicit schemes, and it was found from the cases investigated, that the explicit schemes are preferred. Both transient and steady state solutions were obtained for the two problems.
Dissert. Abstr.

N76-30495# Aeronautical Research Council, London (England).
A NON-AXISYMMETRIC END-WALL BOUNDARY-LAYER THEORY FOR AXIAL COMPRESSOR ROWS
J. W. Railly (Birmingham Univ., England) 1975 22 p refs (ARC-CP-1322; RR-141) Avail: NTIS HC $3.50; HMSO £1.20; PHI

A second equation is deduced for the growth of the end wall boundary layer which connects the work of the mean blade force along the mean velocity with the energy of the secondary disturbances in the boundary layer. Secondary flow theory is used to obtain two equations for two boundary layer parameters. The method is regarded as an addition and modification to the Mellor and Wood treatment. Author

N76-30496# Grumman Aerospace Corp., Bethpage, N.Y.
EFFECTS OF INITIAL BOUNDARY LAYER CONDITIONS ON JET MIXING. FLOW VISUALIZATION INVESTIGATION OF THE EFFECTS OF THE INITIAL BOUNDARY LAYER ON JET MIXING
William G. Hill, Jr., Richard C. Jenkins, and Barry L. Gilbert 9 Sep. 1976 123 p refs Backup document for AIAA Synoptic.

"Effects of the Initial Boundary Layer State on Turbulent Jet Mixing", Scheduled for publication in AIAA Journal in Nov. 1976
(Contract F33615-74-C-4082)
(RE-508; RM-612) Avail: NTIS

Flow field measurements were obtained in free jets produced by 1, 2, and 4-in. diameter axisymmetric nozzles, and by 1/2 and 1-in. two dimensional nozzles with aspect ratios of 21 and 10 1/2, respectively. Axial surveys of mean velcoity along the jet centerlines are presented for each nozzle for different exit velocities under both tripped and untripped conditions. For each operating condition the state of the initial nozzle boundary layer was inferred from an axial survey of turbulence intensity downstream of the nozzle lip. Nozzle wall boundary layer surveys are also presented for a few representative conditions. Additional data are presented for the 2-in. diameter nozzle to compare its operation using different air supplies. In addition, spark schlieren photographs were obtained for the initial mixing regions of two dimensional and axisymmetric low speed jets. A large scale orderly structure was present in the turbulent mixing when the initial boundary layer was laminar. When the boundary layer was tripped, the large scale structure appeared to be destroyed. Author

N76-30497*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRANDTL-MEYER FLOW TABLES FOR PARAHYDROGEN AT TOTAL TEMPERATURES FROM 30K TO 290K AND FOR NITROGEN AT TOTAL TEMPERATURES FROM 100K TO 300K AT TOTAL PRESSURES FROM 1 ATM TO 10 ATM
Richard C. Haut and Jerry B. Adcock (Old Dominion Univ.) Aug. 1976 194 p refs
(NASA-TM-X-73932) Avail: NTIS HC $7.50 CSCL 20D

The dependency of Mach number on the Prandtl-Meyer function was numerically determined by iterating the Prandtl-Meyer function and applying the Muller method to converge on the Mach number for flows in cryogenic parahydrogen and nitrogen at various total pressures and total temperatures. The results are compared with the ideal diatomic gas values and are presented in tabular form. Author

N76-30498*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN EXPERIMENTAL INVESTIGATION OF FLUID FLOW AND HEATING IN VARIOUS RESONANCE TUBE MODES
V. Sarohia, L. H. Back, E. J. Roschke, and S. P. Pathasarathy 1 Sep. 1976 84 p refs
(Contract NAS7-100)
(NASA-CR-148760; JPL-TM-33-780) Avail: NTIS HC $5.00 CSCL 20D

Experiments have been performed to study resonance phenomena in tubes excited by underexpanded jet flows. This investigation comprised the following: Study of the various resonance tube modes under a wide range of nozzle pressure, spacing between nozzle and tube mouth, and different tube length; the effects of these modes on the endwall pressure and gas temperature; flow visualization of both jet and tube flows by spark shadowgraph technique; and measurement of wave speed inside the tube by the laser-schlieren techniques. An extensive study of the free-jet flow was undertaken to explain important aspects of various modes of operation of resonance tube flows. Author

N76-30499# Argonne National Lab., Ill.
COOLING OF LONG TUBE SYSTEMS WITH SUPERFLUID HELIUM
G. Kraft Jun. 1975 84 p refs Transl. into ENGLISH from German Rept. KFK-1786 (West Germany), Apr. 1973 86 p Sponsored by ERDA
(ANL-Trans-1032; KFK-1786) Avail: NTIS HC $5.00

Heat transport experiments with superfluid helium in pipes of 60 to 400 cm length and diameters between 0.3 and 1.0 cm show the existence of a critical heat flow density, when superfluidity breaks down and vaporization onset starts. The critical heat flux is mainly determined by the amount of superheating required for bubble formation. Assuming that nucleation occurs on the superfluid vortex lines or vortex rings, the measured values of superheat can be explained. Author (NSA)

N76-30500# Los Alamos Scientific Lab., N.Mex.
SINGULARITY FITTING IN HYDRODYNAMICAL CALCULATIONS 2
R. D. Richtmyer and R. B. Lazarus Sep. 1975 16 p refs
(Contract W-7405-eng-36)
(LA-6108-MS) Avail: NTIS HC $4.50

Six main results are presented: (1) derivation of a free-surface condition, which relates the acceleration of the surface with the gradient of the square of the sound speed just behind it; (2) an accurate method for the early and middle stages of the development of a rarefaction wave, two orders of magnitude more accurate than a simple direct method used for comparison; (3) the similarity theory of the collapsing free surface, where it is shown that there is a two-parameter family of self-similar solutions for gamma equals 3.9; (4) the similarity theory for the outgoing shock, which takes into account the entropy increase; (5) a zooming method for the study of the asymptotic behavior of solutions of the full initial boundary-value problem; and (6) comparison of two methods for determining the similarity parameter delta by zooming, which shows that the second method is preferred. Author (NSA)

N76-30501# Institut Franco-Allemand de Recherches, St. Louis (France).
EXPERIMENTAL DETERMINATION OF THE THERMAL CONDUCTIVITY OF AIR AND AIR/WATER VAPOR MIXTURES IN THE TEMPERATURE RANGE BETWEEN 2000 K AND 7000 K Final Report, 1974 [EXPERIMENTELLE BESTIMMUNG DER WAERMELEITFAEHIGKEIT VON LUFT/WASSERDAMPFGEMISCHEN IM TEMPERATURBEREICH 2000 K BIS 7000 K]
G. Smeets 16 May 1975 66 p refs In GERMAN; ENGLISH summary
(Contract GfW-RV-11-B35/73(22)-TP)
(ISL-R-118/75) Avail: NTIS HC $4.50

An experimental technique which allows heat conductivity to be determined in hot gas mixtures is described for use in heat transfer calculations in the hypersonic range. A laser differential interferometer was used to determine the density distribution in the thermal boundary layer generated after the reflection of a strong shock wave at the flat end wall of a shock tube. From this, the heat conductivity of the gas heated up under the action of the shock was derived. Heat conductivity of air and mixtures of air and water vapor was determined in the temperature range between 2,000 and 7,000 K.
Author (ESA)

N76-30502# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
BOUNDARY LAYER FLOW HEAT AND MASS TRANSFER TO A MOVING PLANE BOUNDARY LAYER [WAERME- UND STOFFUEBERTRAGUNG AN EINE MITBEWEGTE EBENE GRENZFLAECHE BEI GRENZSCHICHTSTROEMUNG]
Klaus Gauler 1974 126 p refs In GERMAN Sponsored by Deut. Forschungsgemeinschaft
(MPIS-Mitt-60) Avail: NTIS HC $6.00; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 26

Theoretical and experimental investigations on the heat and mass transfer to a moving plane boundary layer are presented. The Prandtl boundary value equations for the velocity and temperature or concentration profiles were integrated numerically. The values obtained were compared with approximative solutions, from which the dependence of the movement of the boundary layer could be established. Under countercurrent conditions a turbulent exchange was shown; the relative velocity is a dominant but not unique parameter. When laminar flow and boundary layer are in the same direction the transfer coefficients increase with increasing flow and boundary layer velocities. ESA

N76-30503# Durham Univ. (England).
SECONDARY FLOW IN CASCADES: THE EFFECT OF COMPRESSIBILITY
H. Marsh London Aeron. Res. Council 1976 34 p refs Supersedes ARC-35835
(ARC-R/M-3778; ARC-35835) Avail: NTIS HC $4.00; HMSO £3.10; PHL $11.95

Kelvin's circulation theorem is applied to compressible flow

through a cascade of blades and expressions are derived for the three streamwise components of vorticity at exit from the cascade. Calculations show that for a decelerating flow, such as a compressor cascade, the distributed secondary vorticity increases as the inlet Mach number increases. However, for an accelerating flow, such as a turbine cascade, there is a wide range of inlet flow angles for which compressibility has little effect on the secondary flow. Author (ESA)

N76-30504# Explosives Research and Development Establishment, Waltham Abbey (England).

EXPERIMENTAL APPARATUS TO STUDY FORCED CONVECTION HEAT TRANSFER TO SUPERCRITICAL CRYOGENIC HYDROGEN

J. C. Beech and H. Ziebland 1975 44 p refs

(ERDE-TN-84; BR51432) Avail: NTIS HC $4.00

A detailed description of the flow cycle of a test rig designed and constructed for experimental studies of the heat transfer characteristics of supercritical hydrogen (energy-rich fuel for rocket propulsion) is presented together with details of construction and instrumentation of the electrically heated, square test section and all other associated instrumentation. In view of the hazards involved in experimenting with this fluid, special attention was paid to the development of automatic control and alarm devices. Brief reference is made to a few tentative trials to prove the proper functioning of all parts of the complex equipment. Surface temperatures and heat fluxes in the rectangular cross-section of the electrically heated tubes are estimated. Author (ESA)

N76-30505# European Space Agency, Paris (France).

A COMPACT VELOCIMETER FOR MEASUREMENTS IN HIGHLY TURBULENT FLOWS

Alain Boutier Apr. 1976 129 p refs Transl. into ENGLISH of 'Velocimetre Compact pour Mesures dans des Ecoulements Tres Turbulents', ONERA, Paris Report ONERA-NT-237, 1974 (ESA-TT-276; ONERA-NT-237) Avail: NTIS HC $6.00

Laser anemometry as a technique for measuring local velocities in fluid flows is discussed. A compact velocimeter was designed for use in wind tunnels. The optimum optical configuration was chosen according to the nature and concentration of the particles present in the aerodynamic flows. A special beam splitter was devised for the determination of the maximum dimensions of this flow, and their evolution as a function of various parameters. Signal processing was performed by means of spectral analysis. Velocity profiles in a supersonic (Mach 3) mixing zone were determined, as well as the corresponding turbulence profiles. Boundary layer probings in transonic flow around an airfoil showed both the possibilities and the limitations of the method. Author (ESA)

N76-30506# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.

EXPERIMENTS ON THE STABILITY OF LIQUID FILMS ADJACENT TO SUPERSONIC BOUNDARY LAYERS

W. S. Saric, Ali H. Nayfeh, and Spyridon G. Lekoudis Feb. 1976 53 p refs

(Grant N00014-72-A-0002; NR Proj. 061-201)

(AD-A022383; VPI-E-75-21) Avail: NTIS CSCL 20/4

The stability of liquid films adjacent to supersonic streams was investigated experimentally and compared with analytical results. Linear theories predict that films adjacent to supersonic streams are much more unstable than those adjacent to subsonic streams. However, our supersonic experimental observations incidated that the liquid film was stable with no entrainment under all test conditions. These conditions included laminar and turbulent boundary layers, a variation in the liquid Reynolds number (Based on flow rate) from 1 to 200, and a variation in the liquid Reynolds number (based on flow rate) from 1 to 200, and a variation in the free-stream unit Reynolds number from 1,600,000/m to 110,000,000/m. These experimental observations can be explained by nonlinear theories which predicts that linear unstable disturbances do not grow indefinitely, but achieve steady-state amplitudes in the supersonic case. The different aspects of the observed wave behavior such as frequency, wavelength, and amplitude are discussed and compared with previous experimental observations and the nonlinear theories. Author (GRA)

N76-30507# EG and G Washington Analytical Services Center, Inc., Rockville, Md.

SEWER FLOW MEASUREMENT: A STATE-OF-THE-ART ASSESSMENT Final Report

Philip E. Shelley and George A. Kirkpatrick Nov. 1975 437 p refs

(Contract EPA-68-03-0426)

(PB-250371/2; EPA-600/2-75-027) Avail: NTIS HC $11.75 CSCL 13B

A brief review of the characteristics of storm and combined sewer flows is given, followed by a general discussion of the need for such flow measurement, the types of flow data required, and the time element in flow data. A discussion of desirable flow measuring equipment characteristics presents both equipment requirements as well as desirable features and includes an equipment evaluation sheet that can be used for a particular application. A compendium of over 70 different generic types of primary flow measurement devices, arranged according to the fundamental physical principles involved is also presented. GRA

N76-30508# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

DETECTING STRUCTURAL HEAT LOSSES WITH MOBILE INFRARED THERMOGRAPHY. PART 3: SURVEY OF USA CRREL

R. H. Munis, R. H. Berger, S. J. Marshall, and M. A. Bush Dec. 1975 13 p refs

(DA Proj. 4A1-61101-A-91D)

(AD-A020375; CRREL-RR-348-Pt-3) Avail: NTIS CSCL 13/13

During the winter of 1973-74 a mobile infrared thermography system was used to survey the USACRREL building at Hanover, New Hampshire. This report provides a description of excessive heat losses at several locations around the building. This report also discusses the need to carefully monitor meteorological conditions before starting a survey of a building exterior to determine if solar radiation decay from the building surface might interfere with thermographic analysis by masking the heat emanating from within the building. GRA

N76-30509# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Fluid, Thermal and Aerospace Sciences.

WORKSHOP ON HEAT AND MASS TRANSFER IN POROUS MEDIA Final Report

Alexander Dybbs Oct. 1975 238 p refs Workshop held at Cleveland, 14-15 Oct. 1974

(Grant NSF GK-43314)

(PB-252387/6; FTAS/TR-75-117) Avail: NTIS HC $8.00 CSCL 07D

Proceedings of the workshop on heat and mass transport in porous media are reported. Key problem areas dealing with heat and mass transport in future porous media were reviewed, and areas of research that might prove to be most fruitful in the future were recommended. The workshop was divided into two areas: fundamental approaches to transport phenomena in porous media and application areas. The volume averaged, cell model, and continuum mechanics approaches were discussed as fundamental approaches: and the transpiration cooling, coal gasification, thermal oil recovery, and permafrost were discussed as applications. GRA

N76-30510# Atomic Energy Research Establishment, Harwell (England). Heat Transfer and Fluid Flow Service.

EXPERIMENTAL METHODS IN TWO-PHASE FLOW STUDIES Final Report

G. F. Hewitt and P. C. Lovegrove Mar. 1976 247 p refs

(PB-252227/4; EPRI/NP-118) Avail: NTIS HC $8.00 CSCL 20D

Experimental methods and instrumentation in two-phase flow are surveyed. Methods are reviewed under first, second, and third order parameters. First order parameters (those of direct interest to the designer) include primary design parameters applying to the steady state (e.g., pressure drop, maximum heat-flux, etc.) and primary design parameters applying to fault conditions (e.g., discharge rate, void growth, etc.). Second order parameters include flow pattern, mass-flow distribution, drop-size measurement, temperature distribution, etc., and are not generally used in the design of the system. However, both they and the

time-varying parameters (third order) may be of vital importance in establishing new methods for evaluation and understanding of design parameters. Modeling of two-phase systems and improving their performance are presented. GRA

N76-30511# Martin Marietta Labs., Baltimore, Md.
NUMERICAL SOLUTION OF THREE-DIMENSIONAL BOUNDARY LAYER EQUATIONS Final Report, 1 Feb. 1973 - 31 Jan. 1975
K. C. Wang Feb. 1976 38 p refs
(Contract DAHC04-73-C-0011)
(AD-A022468; MML-TR-76-14c; ARO-10839.3-E) Avail: NTIS CSCL 20/4

Three-dimensional, incompressible, laminar boundary layer over a spinning blunt body of revolution at incidence and the associated Magnus forces are investigated. Complete solutions for two different, moderate and high, spin rates are obtained by an implicit finite-difference method. A great variety of the circumferential-velocity profiles are determined. Magnus force contributed from the circumferential skin friction and the centrifugal pressure are calculated. These two side-forces partly compensate each other. At lower spin rate, the friction force is larger resulting in a positive Magnus force. At higher spin rate, the opposite is obtained. The changes of the Magnus force from positive at lower spin rate to negative at higher spin rate were previously observed experimentally. GRA

N76-30512# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
UNSTEADY LAMINAR-FLOW SEPARATION IN TUBES. 1: THE EFFECT ON NON-LINEAR STREAMING Interim Report, 1 Sep. 1974 - 31 Aug. 1975
Daniel J. Schneck, Frederick J. Walburn, and Stephen M. Richardson Sep. 1975 68 p refs
(Grant NSF ENG-74-20142)
(PB-251380/2; VPI-E-75-21-A) Avail: NTIS HC $4.50 CSCL 20D

Numerical integration of the equations of motion for pulsatile laminar-flow in diverging channels reveals the presence of a steady streaming velocity which acts to retard downstream flow near the wall of the tube and enhances such motion closer to midstream. The effect of pulsing the flow is thus to cause the point of flow separation to appear initially upstream of its corresponding steady-state location. However, the streaming phenomenon varies directly with the mean flow velocity. It is inversely proportional to the frequency of flow oscillation and rate of channel wall divergence. Therefore, as the streaming disappears, the separation point moves gradually downstream with increasing oscillation frequency. Partial corroboration of these results was obtained by experimental observations using a flow visualization technique. GRA

N76-30513# Illinois Univ., Urbana. Dept. of Civil Engineering.
EXPERIMENTAL STUDIES OF WING-WALL MIXING CONTROL Final Report
W. Hall C. Maxwell and Misganaw Demissie Feb. 1976 82 p refs
(Contract DI-14-31-0001-4079; OWRT Proj. B-083-ILL(1))
(PB-252068/2; UILU-WRC-76-0110; W76-06814) Avail: NTIS HC $5.00 CSCL 20D

Detailed velocity traverses are presented for shallow submerged slot jets without lateral confinement. With wing-walls in place maximum velocities and temperatures were traced for both unheated and heated discharges. These tests were repeated for various wing-wall crest elevations and wing-wall lengths. For the wing-wall tests a typical reynolds number based on slot width was 400,000, and a typical densimetric froude number based on slot width was 40. Some flow combinations were unstable, and tests were conducted to delineate the limits of stability. The tests demonstrate that flow patterns may be controlled using controlled flow over wing-wall crests. A simple design procedure making use of the data is illustrated. GRA

N76-30514# Cincinnati Univ., Ohio. Dept. of Chemical and Nuclear Engineering.
TWO-PHASE PRESSURE DROP ACROSS RESTRICTIONS AND OTHER ABRUPT AREA CHANGES
B. Harshe, A. Hussian, and J. Weisman Apr. 1976 118 p refs
(Contract AT(49-24)-0179)
(PB-251915/5; NUREG-0062) Avail: NTIS HC $5.00 CSCL 20D

As part of continuing study of steady state and transient two-phase pressure drop across abrupt area changes, steady state pressure losses across restrictions of varying geometries were determined using Freon and Freon vapor. The results obtained are consistent with one dimensional momentum balance theory which indicates that the prediction equation to be used depends upon whether or not the vena contracta lies within the insert. Each of these equations requires a knowledge of the void fraction at the inlet, outlet, and vena contracta. It was found that, for very short inserts pressure drops were best predicted assuming slip flow at inlet and cutlet and that the void fraction at the vena contracta was at or near the homogeneous value. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N76-30515 Pennsylvania State Univ., University Park.
NEAR-FIELD CALIBRATION OF UNDERWATER ELECTRO-ACOUSTIC TRANSDUCERS Ph.D. Thesis
Robert D. Marciniak 1975 127 p
Avail: Univ. Microfilms Order No. 76-17191

A near-field acoustic measurement technique, which provides the necessary information for accurately computing far-field radiation characteristics of sound transducers, is conceived, implemented, and evaluated. The underlining analysis is based on evaluating a form of the Helmholtz integral which utilizes a Green's function with particular homogeneous boundary conditions. That is, the Green's function vanishes on the surface of integration and, as a result, only knowledge of the near-field acoustic pressure, and not of its normal derivative, is required for computing the far-field radiation. An experimental program, using underwater sound radiators as test transducers, is conducted to provide corroboration of this near-field technique. Design and construction details of the completely automated near-field measurement system, including the acoustic sensors, the pulsed amplitude-phase electronic measurement system, and the digital scanner system are presented. Dissert. Abstr.

N76-30516 Washington Univ., Seattle.
THE USE OF HOT FILM SENSORS IN GRID TURBULENCE MEASUREMENTS IN LIQUID MERCURY Ph.D. Thesis
Yung Duk Woo 1975 183 p
Avail: Univ. Microfilms Order No. 76-17690

The effect of the thermal capacity of thick thermal boundary layer in liquid mercury on the dynamic response of a hot film sensor was analyzed and a dynamic calibration, proposed. An application of the proposed calibration in a grid turbulence measurement is discussed. The static sensitivity factor was determined experimentally by two different methods; steady calibration and low frequency (0-15 Hz) dynamic calibration. Values obtained by the two methods agreed very well, which indicates that the steady calibration suffices. Dissert. Abstr.

N76-30517 Arizona Univ., Phoenix.
A SOLAR FLUX RADIOMETER FOR THE 1978 PIONEER-VENUS MISSION Ph.D. Thesis
James McLean Palmer 1975 256 p
Avail: Univ. Microfilms Order No. 76-14546

The preliminary design and prototype development of the Solar Flux Radiometer is documented. The program of investigation was divided into eight areas: (1) radiometry; (2) input optics; (3) detectors and filters; (4) analog electronics; (5) digital

electronics; (6) logic and control electronics; (7) mechanical, thermal and electrical interfaces; and (8) calibration and ground support equipment. Each topic was considered in relation to the others, and the investigation was guided by mission-imposed constraints on power, size, weight and bit rate. Dissert. Abstr.

N76-30518 Washington Univ., Seattle.
THE EFFECT OF LIGHT FLUCTUATIONS UPON THE RESPONSE OF PHOTOGRAPHIC FILM, WITH APPLICATIONS TO HOLOGRAPHY Ph.D. Thesis
Ching-Ten Chang 1975 94 p
Avail: Univ. Microfilms Order No. 76-17425

A theoretical and experimental study of the exposure of photographic film, demonstrates differences which depend upon spatial and temporal properties of the exposing light. These differences in developed film density are due primarily to the threshold nature of the photographic detection process. The model used provides a means of explaining discrepancies in related experiments of other investigators. A qualitative discussion of the effects of reciprocity, light spreading, and adjacency effects during development, is included. Application of the photographic detection model to a discussion of interferometric recording is presented. The average amplitude transmittance, and average optical density, are found to be a function of modulation depth and average exposure. For thin amplitude and phase holograms, of small modulation depth, the model provides an explanation for the fact that best linearity and maximum efficiency do not occur at the same bias point. Dissert. Abstr.

N76-30519 Ohio State Univ., Columbus.
AN ON-AXIS FRESNEL ZONE PLATE IMAGING SYSTEM WITH A GERMANIUM GAMMA RAY CAMERA AND COMPUTER RECONSTRUCTION Ph.D. Thesis
Kevin Anthony Kelly 1976 248 p
Avail: Univ. Microfilms Order No. 76-17995

This study examines the feasibility of obtaining germanium gamma camera images by using a Fresnel zone plate aperture to produce shadowgrams and by digital reconstruction of images from the shadowgrams produced. Parametric equations relating zone plate, detector, and field of view parameters are derived. Based on these equations, a general method of designing a zone plate system for any detector is established, and this method is applied to a system with a square high-purity germanium detector. The feasibility of computer reconstruction of shadowgrams is demonstrated, and the kinds of source distributions which are imaged well by the system are established by digital simulation of shadowgrams. Because the system considered contains a small germanium detector, the largest imageable source is one with a frontal area of 12 sq cm. Potential clinical applications for the system include detection of tumors in the skeletal system, the location of myocardial infarcts, and the imaging of small intracranial lesions. Dissert. Abstr.

N76-30520 Ohio State Univ., Columbus.
FILTERING PREDICTION AND INTERPOLATION IN PHOTOGRAMMETRY Ph.D. Thesis
Kunwar Krishan Rampal 1976 207 p
Avail: Univ. Microfilms Order No. 76-18027*

Photogrammetry involves direct observations and mathematical modeling, as in other analytical procedures of mathematical and statistical investigations. In addition to dealing with generalized least squares, the present investigation deals with two other methods, i.e., orthogonal polynomials and least squares spectrum analysis, to obtain estimates of signals and noise. These three methods were applied to the procedures of coordinate transformation, single photo resection and block triangulation. It was demonstrated how noise part can be filtered out of observation from the so-called control/data points and signals can be estimated for predicted points, such as pass points and tie points, of the block triangulation. Finally, it has been shown that the accuracy of block triangulation can be improved using this knowledge of signals and noise. It has also been shown how spot heights can be obtained by interpolation to be used in digitization of terrain models. Dissert. Abstr.

N76-30521 Kansas Univ., Kansas City.
TERRAIN RESPONSE TO AN ORBITING MICROWAVE RADIOMETER/SCATTEROMETER Ph.D. Thesis
Arun Sobti 1975 703 p
Avail: Univ. Microfilms Order No. 76-16783

The Skylab manned space vehicle carried onboard a composite microwave radiometer/scatterometer (designated along with an altimeter as S-193), operating at 13.9 GHz, as part of the Earth Resources Experiment Package. Data from the radiometer and scatterometer are analyzed to satisfy two objectives: to provide design information for future fine resolution sensors, and, to explore the capabilities and limitations of geoscientific investigation with such gross resolution microwave sensors. Histograms of the distribution of backscatter and radiometric brightness temperature are generated for various angles and polarizations for an ensemble of targets in North America, South America and the ocean. Due to the large spatial averaging involved, the dynamic range of backscatter responses at any angle are smaller than those for fine resolution sensors. These dynamic ranges which are a function of incidence angle are larger for the ocean than for land. Dissert. Abstr.

N76-30522 Washington Univ., Seattle.
THE DESIGN, CONSTRUCTION AND EVALUATION OF AN AUTOMATIC AIRBORNE DEVICE FOR COUNTING ICE PARTICLES IN CLOUDS Ph.D. Thesis
Francis Melvill Turner 1975 220 p
Avail: Univ. Microfilms Order No. 76-17665

The counter detects in real-time a reasonably high percentage of the ice particles in a given volume of cloud, while rejecting all but precipitation-sized water drops. This is the first reliable automatic ice particle counter which was developed for use in mixed-phase clouds. The counter utilizes crossed polaroids and the birefringent property of ice for the detection of ice particles. Mie theory was used to minimize the effects of depolarization of the incident, linearly-polarized light due to spherical water drops passing through the system. A logarithmic rate counting circuit, the time constant of which varies as the counting rate, was developed for use with the instrument. The counter provides a real-time output, covering ice particle concentrations in clouds from 0.1 to 1,000 per liter, and may be easily expanded to cover a wider range. Dissert. Abstr.

N76-30523 Tennessee Technological Univ., Cookeville.
AN INVESTIGATION OF THE OPEN-LOOP AMPLIFICATION OF A REYNOLDS NUMBER DEPENDENT PROCESS BY WAVE DISTORTION Ph.D. Thesis
Marie Busck Ventrice 1974 180 p
Avail: Univ. Microfilms Order No. 76-17273

The response of a constant-temperature hot-wire anemometer to sinusoidal and distorted sinusoidal acoustic oscillations is examined. The output of the anemometer is dependent upon the Reynolds number of the flow over the wire. The response is a measure of the interaction between the anemometer output and the acoustic pressure in the neighborhood of the wire. It is an open-loop prediction of the characteristics of actual closed-loop operation of a system. If the open-loop response is large enough, unstable closed-loop operation is predicted. Both an analytical and an experimental study of the anemometer's response was performed. Qualitatively, the results of each are similar--the response of the system to pure sinusoidal acoustic vibration of the fluid surrounding the wire is small, even when the magnitude of the acoustic pressure is quite large; but the response can be increased by as much as an order of magnitude with respect to the sinusoidal case by the addition of distortion. The amplitude and phase of the distortion component, relative to the fundamental component, are the dominant factors in the increase in the response. Dissert. Abstr.

N76-30524*# Rockwell International Science Center, Thousand Oaks, Calif.
A 1.06 MICROMETER AVALANCHE PHOTODIODE RECEIVER Final Report, 23 Jun. 1972 - 2 Sep. 1975
Richard C. Eden Dec. 1975 257 p refs
(Contract NAS5-23134)
(NASA-CR-144787; SC538.54FR) Avail: NTIS HC $9.00 CSCL 14B

The development of a complete solid state 1.06 micron optical receiver which can be used in optical communications at data rates approaching 1.5 Gb/s, or in other applications requiring sensitive, short pulse detection, is reported. This work entailed

both the development of a new type of heterojunction III-V semiconductor alloy avalanche photodiode and an extremely charge-sensitive wideband low noise preamp design making use of GaAs Schottky barrier-gate field effect transistors (GAASFET's) operating in in the negative-feedback transimpedance mode. The electrical characteristics of the device are described. Author

N76-30525*# Rockwell International Science Center, Thousand Oaks, Calif.
THE 1.06 MICROMETER AVALANCHE PHOTODIODE DETECTORS WITH INTEGRATED CIRCUIT PREAMPLIFIERS Final Report, 19 Mar. 1974 - 18 Mar. 1975
Richard C. Eden Dec. 1975 257 p refs
(Contract NAS5-23333)
(NASA-CR-144788; SC582.28FR) Avail: NTIS HC $9.00 CSCL 14B

The development of a complete solid state 1.06 micron optical receiver which can be used in optical communications at data rates approaching 1.5 Gb/s, or in other applications requiring sensitive, short-pulse detection, is reported. This work entailed both the development of a new type of heterojunction 3-5 semiconductor alloy avalanche photodiode and an extremely charge-sensitive wideband low-noise preamp design making use of GaAs Schottky barrier-gate field effect transistors. Author

N76-30526*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
TEST AND EVALUATION OF WATER VAPOR RADIOMETERS AND DETERMINATION OF THEIR CAPABILITY TO MEASURE TROPOSPHERIC PROPAGATION PATH LENGTH Final Report, 21 Feb. 1975 - 26 Jun. 1976
J. M. Moran and H. Penfield Jun. 1976 101 p refs
(Contract NAS5-20975)
(NASA-CR-144800) Avail: NTIS HC $5.50 CSCL 14B

Two dual frequency microwave radiometers were refurbished and operated on steerable search light mounts. The peak sidelobes of the antennas were found to be about -22 db. Absolute temperature measurements had an accuracy of 1.5 percent. The gain stability was typically 0.3 K over many hours. There were 330 radiosonde profiles taken from four stations in the northeast. The estimates of wet path from brightness temperatures at 19 and 22 GHz with no measurement errors were better than 0.3 cm. The brightness temperatures measured with the radiometers were compared with other brightness temperatures. The radiometers agreed with each other at an accuracy of 1.2 K. The rms residual in the correlation between measured brightness temperature and the calculated wet path length in the zenith direction was 1.5 cm. Author

N76-30527*# American Science and Engineering, Inc., Cambridge, Mass.
FABRICATION OF A FOCUSING SOFT X-RAY COLLECTOR PAYLOAD Final Report, 22 Nov. 1972 - 30 Jun. 1976
J. M. Davis, A. R. DeCaprio, H. Manko, and J. W. S. Ting 30 Jun. 1976 44 p refs
(Contract NASw-2292)
(NASA-CR-144804; ASE-3857) Avail: NTIS HC $4.00 CSCL 14B

A large area X-ray focusing collector with arc minute resolution and a position sensitive detector capable of operating in the soft X-ray region was developed for use on sounding rockets in studying stellar X-ray sources. The focusing payload consists of the following components, which are described: (1) a crossed paraboloid mirror assembly; (2) an aspect camera and star tracker; (3) a focal plane assembly containing an imaging proportional counter and its preamplifiers, high voltage power supplies and gas system; (4) a fiducial system; and (5) housekeeping data handling, instrumentation and telemetry electronics. The design, tests, and operation are described. F.O.S.

N76-30528*# Aeroflex Labs., Inc., Plainview, N.Y.
DESIGN, BUILDING AND TEST OF ONE PROTOTYPE AND FOUR FINAL POSITION SENSOR ASSEMBLIES: HALL EFFECT POSITION SENSORS Final Report
Mar. 1976 16 p
(Contract NAS5-20097)
(NASA-CR-144806) Avail: NTIS HC $3.50 CSCL 14B

This report covers the development of a three channel Hall effect position sensing system for the commutation of a three phase dc torquer motor. The effort consisted of the evaluation, modification and re-packaging of a commercial position sensor and the design of a target configuration unique to this application. The resulting design meets the contract requirements and, furthermore, the test results indicate not only the practicality and versatility of the design, but also that there may be higher limits of resolution and accuracy achievable. Author

N76-30529*# Old Dominion Univ. Research Foundation, Norfolk, Va.
MOLECULAR BEAM MASS SPECTROMETER DEVELOPMENT Final Report
Frank J. Brock and J. E. Hueser Aug. 1976 195 p refs
(Grant NGR-47-003-043)
(NASA-CR-148724; PGSTR-PH76-43) Avail: NTIS HC $7.50 CSCL 14B

An analytical model, based on the kinetics theory of a drifting Maxwellian gas is used to determine the nonequilibrium molecular density distribution within a hemispherical shell open aft with its axis parallel to its velocity. The concept of a molecular shield in terrestrial orbit above 200 km is also analyzed using the kinetic theory of a drifting Maxwellian gas. Data are presented for the components of the gas density within the shield due to the free stream atmosphere, outgassing from the shield and enclosed experiments, and atmospheric gas scattered off a shield orbiter system. A description is given of a FORTRAN program for computating the three dimensional transition flow regime past the space shuttle orbiter that employs the Monte Carlo simulation method to model real flow by some thousands of simulated molecules. G.G.

N76-30530*# Georgia Inst. of Tech., Atlanta. School of Electrical Engineering.
STUDY OF MULTIPLE HOLOGRAM RECORDING IN LITHIUM NIOBATE Final Report, 1 Oct. 1973 - 1 Jan. 1976
T. K. Gaylord and W. R. Callen Jan. 1976 64 p refs
(Contract NAS8-30246)
(NASA-CR-149986) Avail: NTIS HC $4.50 CSCL 14E

The results of a number of theoretical and experimental studies relating to multiple hologram recording in lithium niobate are reported. The analysis of holographic gratings stored in lithium niobate has been extended to cover a more realistic range of physical situations. A new successful dynamic (feedback) theory for describing recording, nondestructive reading, erasure, enhancement, and angular sensitivity has been developed. In addition, the possible architectures of mass data storage systems have been studied. Author

N76-30531# Sandia Corp., Albuquerque, N.Mex.
DUAL BEAM VIDICON DIGITIZER
T. L. Evans Jan. 1976 17 p
(Contract AT(29-1)-789)
(SAND-75-0642) Avail: NTIS HC $3.50

A vidicon waveform digitizer which can simultaneously digitize two independent signals was developed. Either transient or repetitive waveforms can be digitized with this system. A dual beam oscilloscope is used as the signal input device. The light from the oscilloscope traces is optically coupled to a television camera, where the signals are temporarily stored prior to digitizing. Author (NSA)

N76-30532# Maryland Univ., College Park. Dept. of Physics and Astronomy.
GAUGE TRANSFORMATION AND QUANTUM MECHANICS (2): PHYSICAL INTERPRETATION OF CLASSICAL GAUGE TRANSFORMATIONS
K. H. Yang 1976 45 p refs
(ORO-4856-47) Avail: NTIS HC $4.00

The potentials, vector and scalar, in gauges are obtained in closed forms by the Green's function method. These closed form solutions are explicitly expressed only in terms of the charge and current densities. The physical interpretation is on how potentials propagate from the charge and current densities. The Coulomb gauge and the Lorentz gauge are special cases of a new gauge, which is defined. It is called the complete alpha-Lorentz gauge. The scalar potential propagates at speed alpha c

from the charge density for any positive alpha. Discussions on the Coulomb gauge are based on the results obtained by letting alpha go to (positive) infinity. Guided by Maxwell's interpretation, a new decomposition of the vector potential is introduced in the Lorentz gauge into a longitudinal and a transverse component. For an arbitrary charge and current distribution, it is shown that the transverse component will generate all the fields only in the radiation zone. Author (NSA)

N76-30533# Battelle Inst., Frankfurt am Main (West Germany).
DEVELOPMENT OF PYROELECTRIC DETECTORS FOR HORIZON SENSORS AND OTHER SENSOR SYSTEMS [ENTWICKLUNG VON PYROELEKTRISCHEN DETEKTOREN FUER HORIZONTSENSOREN UND ANDERE SENSORSYSTEME]
Rasmus Beck, Karl Guers, and Michael Rother Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1975 38 p In GERMAN; ENGLISH summary
(Contracts BMFT-WRT-2073; GfW-RV-11-V65/73)
(BMFT-FB-W-75-27) Avail: NTIS HC $4.00; ZLDI, Munich DM 8

A theoretical study was made of the suitability of ferroelectric crystals with permanent dipole moment for pyroelectric detectors. The conditions for growing especially suitable crystals were established. The crystals were produced by crucible-free zone melting using a laser. After the pyroelectric properties had been measured, the most suitable crystals were selected and the first detectors fabricated. It was found that even without further optimization they were of the same quality as the detectors used so far (thermocouples). Author (ESA)

N76-30534# Siemens A.G., Munich (West Germany).
SUPERCONDUCTING LENSES FOR HIGH VOLTAGE MICROSCOPY Final Report [SUPRALEITENDE LINSEN FUER HOECHSTSPANNUNGSMIKROSKOPIE]
Isolde Dietrich, Fred Fox, Erwin Knapek, Guy Lefranc, Karl Nachtrieb, Reinhard Weyl, and Helmut Zerbst Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1975 90 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-75-44) Avail: NTIS HC $5.00; ZLDI, Munich DM 18,90

A superconducting shielding lens was designed and its applicability as an objective lens in electron microscopy, in particular at high beam voltages, was tested. The following requirements had to be fulfilled: Construction of a testing microscope for beam voltages in the 400 kV range, preparation of superconducting material with high shielding capability, orientation investigations outside of the electron microscope to determine image aberrations, and design of specific cryotechnic devices. The resolution test was carried out in a cryogenic lens system consisting of the shielding lens as an objective lens, the iron circuit intermediate lens with a superconducting coil, and superconducting correcting devices. A lattice resolution of 0.34 nm and a point resolution below 0.5 nm at a beam voltage of 350 kV could be proved. A second system, subsequently constructed and containing four superconducting lenses, was provided with a side entry stage. Author (ESA)

N76-30535# Institut Franco-Allemand de Recherches, St. Louis (France).
FREQUENCY ANALYSIS OF VELOCITY FLUCTUATIONS DETERMINED WITH A LASER ANEMOMETER [UEBERLEGUNGEN ZUR FREQUENZANALYSE DER MIT EINEM LASERANEMOMETER ERMITTELTEN GESCHWINDIGKEITSSCHWANKUNGEN]
H. J. Schaefer and H. J. Pfeifer 21 Feb. 1975 21 p refs In GERMAN
(ISL-R-105/75) Avail: NTIS HC $3.50

It is shown that laser anemometry methods, using simulated velocity profiles, can be used to determine the power spectrum of velocity fluctuations for limited available data which requires an extremely long cycle time for acquisition. ESA

N76-30536# Royal Aircraft Establishment, Farnborough (England).
THE MEASUREMENT OF THE RESONANT FREQUENCY OF SHOCK ACCELEROMETERS
W. H. E. Hampton and J. Knight Dec. 1975 48 p refs
(RAE-TR-75122; BR50454) Avail: NTIS HC $4.00

In order to assess the performance of accelerometers to be used in weapons and which, therefore, must be capable of measuring high amplitude and fast rise time shocks, studies were made of three methods (electrical, vibration, and shock) for measuring the mounted resonant frequency of shock accelerometers; consideration was given to the problem of analyzing and interpreting the results obtained. The effects of mounting the accelerometers are discussed and both practical and theoretical results are given. Recommendations as to further investigations in this area are made and conclusions are drawn with respect to the applicability of these methods to accelerometers having resonant frequencies in the range from 50 to 250 kHz.
Author (ESA)

N76-30537# Rutgers Univ., New Brunswick, N.J. School of Chemistry.
IMAGE-FORMING REACTIONS AND SENSITIZING DYES Final Report, 15 Jan. 1971 - 14 Jan. 1975
George R. Bird 1976 21 p refs
(Grant AF-AFOSR-2026-71; AF Proj. 9536)
(AD-A023053; AFOSR-76-0291TR) Avail: NTIS CSCL 14/5

This research was undertaken to generate new insights on the fundamental properties which limit the performance of chemical image-forming systems. The principal areas investigated were: Dye sensitization of photoconductivity and of silver latent image formation; the ultimate information-recording capabilities of organic imaging systems having chemical amplification, and strategies for overcoming problems of thermal instability in these systems; and methods for simultaneously improving sensitivity and detective quantum efficiency of conventional silver halide photographic systems. Author (GRA)

N76-30538# National Bureau of Standards, Washington, D.C. Electronic Technology Div.
NBS INTERAGENCY TRANSDUCER PROJECT Progress Report, 1 Jan. - 30 Jun. 1975
Paul S. Lederer and John S. Hilten Apr. 1976 24 p refs
(PB-251918/9; NBSIR-76-1038; PR-3) Avail: NTIS HC $3.50 CSCL 14B

Concluding efforts related to the development of a test method for evaluating the effects of short-duration, thermal radiant-energy transients pressure-transducer response are described. The method consists of monitoring pressure-transducer output (zero shift with the transducer at atmospheric pressures) as the transducer is exposed to radiation resulting from the ignition of a photographic flashbulb or from the discharge of an electronic flash. Thermal energy pulses as great as 0.1 J/square centimeters, with durations of about 6 ms, were generated using an electronic flash; pulses of up to 2.2 J/square centimeters, with durations of about 37 ms, were generated using No. 22 flashbulbs. GRA

N76-30539# Epsilon Labs., Bedford, Mass.
MISSILE PLUME TEMPERATURE SENSOR AND ARCAS ROCKET VLF/LF PAYLOAD Final Report, 3 Aug. 1973 - 3 Jun. 1975
John Dulchinos and Theodore Ciesielski Aug. 1975 20 p refs
(Contract F19628-74-C-0052; AF Proj. 4603)
(AD-A018058; AFCRL-TR-75-0517) Avail: NTIS CSCL 14/2

Two separate types of instrumentation packages are described. The first relates to a requirement for measuring missile plume temperatures. A low weight, low volume projectile has been designed and fabricated to include a fine tungsten wire resistance thermometer. The variation in resistance as the projectile transverses the plume at ground level after vehicle ascent is telemetered at 1,680 MHz to a ground receiver. The second system describes a VLF/LF experiment package for inclusion in an Arcas payload. Transverse Electric and Transverse Magnetic components propagated through the upper atmosphere in the 20 kHz to 60 kHz range are detected, processed and retransmitted to the ground at 1,680 MHz. The transmission to the ground is achieved by a quadrupole antenna system consisting of four 1/4 lambda stubs. The entire payload weight is approximately 8.5 lbs. and will achieve a peak altitude in excess of 70 km.
Author

N76-30540# Naval Surface Weapons Center, White Oak, Md.
NITINOL TEMPERATURE MONITORING DEVICES
W. J. Buehler and Charles E. Sutton 9 Jan. 1976 33 p refs
(AD-A021578; NSWC/WOL/TR-75-140) Avail: NTIS CSCL 06/12

Several Nitinol sensor designs for monitoring blood temperature during storage and shipment were examined. Nitinol alloy with heat-recovery in the 6 C to 18 C range was produced and used in the study. Tension and torsion straining modes were rejected in favor of bending. A simple and effective temperature monitoring design is described. GRA

N76-30541# National Bureau of Standards, Boulder, Colo. Time and Frequency Div.
AN INFRARED SPECTROMETER UTILIZING A SPIN FLIP RAMAN LASER, IR FREQUENCY SYNTHESIS TECHNIQUES, AND CO2 LASER FREQUENCY STANDARDS
J. S. Wells, F. R. Peterson, G. E. Streit (NOAA, Boulder, Colo.), P. D. Goldan (NOAA, Boulder, Colo.), and C. M. Sadowski (NOAA, Boulder, Colo.) Jan. 1976 58 p refs
(PB-250663/2; NBS-TN-670) Avail: NTIS HC $4.50 CSCL 13B

The central part of this spectrometer is a cw spin flip Raman laser which operates between 1,900 and 1,800/cm. The spin flip laser has demonstrated capabilities of resolving spectra separated by 0.01/cm and shows promise of exceeding this resolution capability. When used with an opto-acoustic detector or with a detector and a flow system, it is capable of making a variety of measurements of environmental interest. By using CO2 laser standards as frequency references and incorporating infrared frequency synthesis techniques, spectroscopy with the spin flip Raman laser can be put on a frequency metrology basis. A CO2 laser has been used with a metal-oxide-metal diode to synthesize a known frequency reference which was used to stabilize the CO pump laser. GRA

N76-30542# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.
AN ELECTRICALLY CALIBRATED PYROELECTRIC RADIOMETER SYSTEM
C. A. Hamilton, G. W. Day, and R. J. Phelan, Jr. Mar. 1976 53 p refs
(PB-252169/8; NBS-TN-678) Avail: NTIS HC $4.50 CSCL 14B

A new type of radiometer based on an electrically calibrated pyroelectric detector is described. Emphasis is placed on system design and analysis with careful consideration of design trade-offs. An evaluation of both systematic and random errors for the complete system yields an expression for the accuracy relative to the electrical standards by which it is calibrated. The analysis is sufficiently general and can be applied to any electrically calibrated pyroelectric radiometer which employs the same basic principals. GRA

N76-30543# National Bureau of Standards, Boulder, Colo. Time and Frequency Div.
FREQUENCY DOMAIN STABILITY MEASUREMENTS: A TUTORIAL INTRODUCTION
David A. Howe Mar. 1976 30 p refs
(PB-252171/4; NBS-TN-679) Avail: NTIS HC $4.00 CSCL 14B

The concept of stability measurements of oscillators by spectral analysis is introduced. The equipment and set-up for stability measurements in the frequency domain are outlined. Examples and typical results are presented. Physical interpretations of common noise processes are discussed. A table is provided by which typical frequency domain stability characteristics may be translated to time domain stability characteristics. GRA

N76-30544# Stanford Research Inst., Menlo Park, Calif.
CHARACTERIZATION OF THE STANDFORD RESEARCH INSTITUTE LARGE-SCALE HEAT-RELEASE-RATE CALORIMETER Final Report
Stanley B. Martin Oct. 1975 81 p refs
(Contract NBS-4-36903; SRI Proj. PYU-3534)
(PB-251682/1; NBS-GCR-76-54) Avail: NTIS HC $5.00 CSCL 14B

A scaled up version of the NBS heat release rate calorimeter was constructed. It can measure specimen size up to 18 x 24 inches over an incident radiant flux range of 1.5 to 7.0 W/cm sq. The performance of the instrument is evaluated and various calibration procedures are described. The effect of specimen size and irradiance is investigated and data are compared with that taken in the NBS instrument. The use of the heat release rate calorimeter as a research tool is discussed. In particular a limiting thermal index and a thermal sensitivity index are defined. GRA

36 LASERS AND MASERS

Includes parametric amplifiers.

N76-30545 Texas Technological Univ., Lubbock.
THEORETICAL APPROACHES TO THE ANALYSIS OF LASER RESONATORS Ph.D. Thesis
Hugh Landon Southall 1975 174 p
Avail: Univ. Microfilms Order No. 76-17764

Several theoretical methods for the determination of optical resonator modes are considered. The classical integral equation is described. An approximation procedure is presented in which the integral equation is converted to a functional equation. The solution requires much less effort than the usual iterative methods. Comparisons of mode shapes obtained by the two methods agree. The alternate approach of numerically integrating the scalar Helmholtz equation directly is also investigated. The modes obtained by this method are shown to agree well with those obtained from the integral equation. Dissert. Abstr.

N76-30546 Wyoming Univ., Laramie.
INTENSE FIELD QUANTUM ELECTRODYNAMICS WITH APPLICATIONS TO THE INTERACTION OF LASER LIGHT WITH ELECTRONS Ph.D. Thesis
Mojtaba Jafarpour 1975 127 p
Avail: Univ. Microfilms Order No. 76-13519

The interaction of free electrons with laser light is investigated using nonrelativistic quantum electrodynamics. A realistic model is proposed for a laser beam and the corresponding quantum mechanical state is derived, using the coherent state. A second-quantized formalism, based on the Dyson expansion of the evolution operator and Wick's theorem, then leads to the formulation of nonrelativistic quantum electrodynamics for laser-electron interactions. A self-energy analysis, based on the counterterm method, is developed which covers both radiative corrections and external field effects. The application of the theory leads to intensity-dependent cross sections for Thomson scattering and for the generation of second harmonics. Intensity-dependent self energy effects are also shown to exist, and electron mass and energy shifts are derived. All the intensity-dependent effects are more pronounced at lower frequencies and higher intensities. Dissert. Abstr.

N76-30547 Maryland Univ., College Park.
LASER PROPAGATION IN THE ATMOSPHERE Ph.D. Thesis
Eddy Huo-ping Huang 1975 112 p
Avail: Univ. Microfilms Order No. 76-17805

The problem is the variance and covariance of amplitude in a focused Gaussian laser beam propagating in a random medium with a von Karman turbulence spectrum. The Rytov method is employed, and a numerical program is used to calculate the effects of the beam parameters (aperture size, wavelength and focal length) and atmospheric turbulence parameters (structure constant, inner and outer scale of turbulence) upon the covariance function. Dissert. Abstr.

N76-30548 Idaho Univ., Moscow.
LASER-INDUCED FLUORESCENCE SPECTRUM OF NITROGEN DIOXIDE IN THE NEIGHBORHOOD OF 6125 A Ph.D. Thesis
Tun Chien Lee 1975 88 p
Avail: Univ. Microfilms Order No. 76-16893

The resonance fluorescence spectrum of nitrogen dioxide is excited by a tunable CW dye laser in the neighborhood of 6,125 A. The rotational molecular constants for the excited electronic state are determined as A' sub [v] 6.60/cm + or -

0.06/cm and B' sub [v] = 0.454/cm + or - 0.005/cm. The band origin is at 16,322.6/cm + or - 0.8/cm. The tentative vibrational constants are estimated as Omega' sub 1 = 1378.2/cm and Omega' sub 2 = 872.3/cm, and the vibrational assignement is (0,5,0). The structure parameters deduced for this state are r= 1.18 A + or - 0.01 A and Theta = 128 deg + or - 0.5 deg. Dissert. Abstr.

N76-30549 Stanford Univ., Calif.
APPLICATIONS OF LASERS TO CHEMICAL PROBLEMS Ph.D. Thesis
Timothy Joseph OLeary 1976 196 p
Avail: Univ. Microfilms Order No. 76-18791

Several applications of lasers to the solution of chemical problems are discussed. The application of photochemical recoil scattering of a molecular beam to isotope separation is considered, and its theoretical superiority to other isotope separation methods discussed. Failure of an experimental attempt to separate the bromine isotopes by this method is interpreted in terms of an inherently low rate of collisionless predissociation in bromine. The photochemistry of hydrogen bromide/deuterium bromide mixtures exposed to 2537A light was investigated. Results of experiments in which various mixtures of the bromides were irradiated, then assayed for H2, HD and D2 are interpreted in terms of several kinetic models. Agreement between experimental results and predictions made on the basis of phase space trajectory calculations is satisfactory. Unlike previous experiments designed to check these calculations, no major theoretical assumptions are required. Dissert. Abstr.

N76-30550*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE NASA HIGH POWER CARBON DIOXIDE LASER: A VERSATILE TOOL FOR LASER APPLICATIONS
R. B. Lancashire, D. L. Alger, E. J. Manista, J. G. Slaby, J. W. Dunning, and R. M. Stubbs 1976 12 p refs Presented at Technical Symp. on Industrial Applications of High Power Laser Technol., San Diego, Calif., 23-27 Aug. 1976; sponsored by Soc. of Photo-Optical Instrumentation Engineers
(NASA-TM-X-73485; E-8871) Avail: NTIS HC $3.50 CSCL 20E

A closed-cycle, continuous wave, carbon dioxide high power laser has been designed and fabricated to support research for the identification and evaluation of possible high power laser applications. The device is designed to generate up to 70 kW of laser power in annular shape beams from 1 to 9 cm in diameter. Electric discharge, either self sustained or electron beam sustained, is used for excitation. This laser facility provides a versatile tool on which research can be performed to advance the state-of-the-art technology of high power CO2 lasers in such areas as electric excitation, laser chemistry, and quality of output beams. The facility provides a well defined, continuous wave beam for various application experiments, such as propulsion, power conversion, and materials processing. Author

N76-30551# RAND Corp., Santa Monica, Calif.
PRECISION-GUIDED WEAPONS
James F. Digby Mar. 1975 45 p refs
(AD-A022180; P-5353) Avail: NTIS CSCL 17/7

The first part of this paper discusses enough about the mechanics of these weapons to give the reader a feel for how they work and provide brief descriptions of some of the more important weapons associated with non-nuclear land combat. The brief treatment here mentions only a fraction of current PGM developments; it is characteristic of the pace of development that dozens of new PGM types in many countries reach operational testing each year. The second part of the paper focusses on a number of important and so far unresolved implications of the new weapons; it discusses their likely effects on force posture and on the conduct of warfare. For example, what is their effect on the relative usefulness of the advanced tank, the complex fighter-bomber, and the big aircraft carrier? What will be the consequences for the organization of land forces, and for their tactics? GRA

N76-30552# Los Alamos Scientific Lab., N.Mex.
LASER-ENHANCED CHEMICAL REACTIONS AND THE LIQUID STATE. 2: POSSIBLE APPLICATIONS TO NUCLEAR FUEL PROCESSING
G. L. DePoorter and C. K. Rofer-DePoorter Jan. 1976 11 p refs
(Contract W-7405-eng-36)
(LA-5630-MS-Vol-2) Avail: NTIS HC $4.50

Laser photochemistry is surveyed as a possible improvement upon the purex process for reprocessing spent nuclear fuel. Most of the compounds of spent nuclear fuel are photochemically active, and lasers can be used to selectively excite individual chemical species. The great variety of chemical species present and the degree of separation that must be achieved present difficulties in reprocessing. Lasers may be able to improve the necessary separations by photochemical reaction or effects on rates and equilibria of reactions. Author (NSA)

N76-30553# AEG-Telefunken, Frankfurt am Main (West Germany).
LASER RADIATION SOURCES FOR GAS ANALYSIS EQUIPMENT IN THE 2-20 MICRON SPECTRAL RANGE. PART 1: LASER DIODES FOR 4-20 MICRON Final Report [LASERSTRAHLUNGSQUELLEN FUER GASANALYSENGERAETE IM SPEKTRALBEREICH VON 2-20 mum. TEIL 1: LASERDIODEN FUER 4-20 mum]
Horst Preier, W. Riedel, and K. Duh Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1975 136 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-75-46-Pt-1) Avail: NTIS HC $6.00; ZLDI, Munich DM 28,60

Tunable diode lasers emitting in the infrared spectral region can be used to advantage in gas spectrometers due to their relatively simple structure and small size. It is known that different ternary compounds of lead chalcogenides can emit in the entire spectral region of interest. Investigations were concentrated on PbS(1-x)Se(x), which can be used for the detection of important gases like CO and NO. Single crystals with high perfection and with dimensions of up to 1 cm on one side could be grown by a modified sublimation method. Diffused laser diodes could be operated up to 40 K in CW-mode and to 130 K in pulse mode. Temperature tuning was analyzed in detail. Detection of CO and NO gases was achieved with pulsed lasers at a temperature of about 100 K. In order to increase the operation temperature further, an investigation of stripe and heterostructure lasers was initiated. Author (ESA)

N76-30554# European Space Agency, Paris (France).
PARAMETRIC STUDY OF THE GAIN IN CARBON DIOXIDE LASERS
Jean Bonnet Apr. 1976 71 p refs Transl. into ENGLISH of 'Etude Parametrique du Gain des Lasers CO2', ONERA, Paris Report ONERA-NT-1975-4, 1975
(ESA-TT-284; ONERA-NT-1975-4) Avail: NTIS HC $4.50

A theoretical model for predicting the performance of an electric CO2 laser and for checking its precision was established. The small signal gain of a pulse mode amplifier was calculated with this model and compared with the results of measurements performed on an electron beam amplifier, for ten mixture ratios of CO2, N2, and He at various excitation conditions. The agreement obtained between prediction and measurement led to the conclusion that the model is valid, but with a restriction in the case of pure CO2. Author (ESA)

N76-30555# Hughes Research Labs., Malibu, Calif.
ELECTRON GUN TECHNOLOGY Semiannual Technical Report, 1 Jul. - 31 Dec. 1975
W. M. Clark and G. J. Dunning Feb. 1976 31 p refs
(Contract N00014-72-C-0496; DARPA Order 1807)
(AD-A021926; SATR-7) Avail: NTIS CSCL 20/5

The objective of this program is to develop various cold-cathode electron guns to demonstrate that they have properties suitable for application to e-beam lasers. The plasma cathode electron gun has been the subject of study for the previous periods of this program. The source of electrons in the plasma cathode e-gun is a plasma generated within a low voltage, cold surface, hollow cathode discharge. The device is characterized by durability, low cost, low power consumption, small size, and fast turn-on in comparison with thermionic e-guns. GRA

N76-30556# Wellesley Coll., Mass.
GEODETIC LASER SYSTEM Final Report, 7 May - 7 Nov. 1975
Hobert W. French Jan. 1976 10 p ref
(Contract F19628-75-C-0168; AF Proj. 7600; AF Proj. 0602)
(AD-A021911; AFCRL-TR-76-0050) Avail: NTIS CSCL 20/5

The purpose of this program was to construct, test, and install an optical receiver and a laser collimator on a tracking mount located at AFCRL, Hanscom AFB, and to perform operational tests. The work was started by another contractor, but was not completed. The major work accompiished on this program was the modification and completion of the design, the completion of the fabrication of the government supplied optical components, and the fabrication of essentially all the major mechanical components. Work was terminated prior to assembly and test. GRA

N76-30557# National Bureau of Standards, Boulder, Colo.
LASER INDUCED DAMAGE IN OPTICAL MATERIALS: 1975. PROCEEDINGS OF A SYMPOSIUM (7TH) SPONSORED BY NATIONAL BUREAU OF STANDARDS, AMERICAN SOCIETY FOR TESTING AND MATERIALS, OFFICE OF NAVAL RESEARCH AND ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION, HELD AT NATIONAL BUREAU OF STANDARDS, BOULDER, COLO. ON JULY 29-31, 1975 Annual Report
Alexander J. Glass, ed. (Lawrence Livermore Lab.) and Arthur H. Guenther, ed. (Air Force Weapons Lab., Kirkland AFB, N. Mex.) Apr. 1976 440 p refs
(PB-252186/2; NBS-SP-435) Avail: NTIS HC $11.75 CSCL 20E

The Seventh ERDA-ASTM-ONR-NBS Symposium on Laser Induced Damage in Optical Materials was held at the National Bureau of Standards in Boulder, Colorado, on July 29-31 of this year. Over 150 attendees at the symposium heard 42 papers on topics relating fabrication procedures to laser induced damage in optical materials; on metal mirrors; in infrared window materials; the multipulse, wavelength and pulse length dependence of damage thresholds; damage in dielectric films and at exposed surfaces; as well as theoretical discussions on avalanche ionization and multiphoton processes of importance at shorter wavelengths. Of particular importance was the sealing relations developed from several parametric studies relating fundamental properties (refractive index surface roughness, etc.) to the damage threshold. GRA

N76-30558# Hughes Research Labs., Malibu, Calif.
LASER WINDOW SURFACE FINISHING AND COATING SCIENCE Semiannual Technical Report, 2 Jun. - 2 Dec. 1975
M. Braunstein, S. D. Allen, A. I. Braunstein, C. R. Giuliano, and J. E. Rudisill Jan. 1976 39 p refs
(Contract F19628-75-C-0135; ARPA Order 2415)
(AD-A022684; AFCRL-TR-76-0048; SATR-2) Avail: NTIS CSCL 20/5

The objectives and the progress achieved in a program to study the surface finishing and coating of laser windows for high energy laser applications in the 10.6 micrometers, 5.3 micrometers and 3.8 micrometers wavelength regions are reported. Recent chemical-mechanical optical polishing procedures use 1,2-propanediol, whose surface etch rate appears to match the rate of formation of damaged surface layers produced during polishing. Polycrystalline windows approximately 5 cm in diameter and 1 cm thick have been polished flat to 1/4 fringe in the visible with faces parallel to 2 arc sec, total optical absorption loss at 10.6 micrometers of 0.0007 for a 1 cm thick piece was measured after polishing. Recent coating efforts have placed emphasis on the use of three layer antireflection coatings produced in ultrahigh vacuum in an attempt to remove the absorption limitation of (0.1%) per surface for the two layer coatings produced previously which have prevented the achievement of a program goal of (0.1%) coating loss per surface at 10.6 micrometers. With the new three layer coating designs it was possible to achieve coating absorption losses as low as 0.05% per surface for ZnSe/ThF4/ZnSe designs. The rather high values of absorption index (K=.003) for ThF4 films used at 10.6 micrometers can now be incorporated in our new designs and we can still achieve coatings with less than 0.1% absorption losses. GRA

N76-30559# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala.
TECHNIQUES FOR REMOTE SENSING OF MISSILE POSITION AND ATTITUDE
Robert G. Conard, Kynric M. Pell, John E. Nydahl, and David B. Brown 1 Oct. 1975 36 p refs
(DA Proj. 1M3-62303-A-214)
(AD-A021974; RD-76-11) Avail: NTIS CSCL 20/5

This report presents a mathematical analysis of a three station laser tracker and a two station laser tracker concept for measuring the position and attitude of spinning rockets and missiles. An assessment is included of the errors of attitude measurements which result from the geometrical location of the rocket relative to the laser tracking stations. The two station system includes a concept developed by Ballistic Research Laboratories for the yawsonde attitude measurement system. Whereas the yawsonde utilizes the sun as the energy source, this system will utilize two laser trackers. Two arrays of roof reflectors which are skewed to the rocket axis will be employed on the rocket to reflect the laser beam. A mathematical analysis is presented for this system. The determination of the attitude angles requires the solution of two simultaneous differential equations. Since multiple solutions to these equations can be obtained, additional analysis of this system is warranted. Author (GRA)

N76-30560# Massachusetts Inst. of Tech., Cambridge. Francis Bitter National Magnet Lab.
TUNABLE FAR-INFRARED AND SUBMILLIMETER SOURCES Final Technical Report
Benjamin Lax 1975 21 p refs Sponsored in part by Dept. of Air Force
(Contract N00014-67-A-0204-0071)
(AD-A021995) Avail: NTIS CSCL 20/5

This report is a summary of the work done towards the development of tunable submillimeter and far infrared (FIR) radiation sources. In this work the authors developed the principle of noncollinear phase-matched difference-frequency optical mixing of two laser beams for the generation of FIR radiation. Using this technique the authors demonstrated wide range of tunability of FIR from about 70 micrometer to several mm by mixing two grating-tuned pulsed TEA CO2 laser beams in a crystal of GaAs. New noncollinear 'folded' geometries were considered and used to increase the mixing efficiency. In addition to the pulsed system, the authors also demonstrated for the first time narrow bend CW generation of FIR tunable over the same wavelength region. In the last year additional improvements and modifications have been made in both the pulsed and CW systems. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N76-30561 Ohio State Univ., Columbus.
A THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THREE DYNAMICALLY COMPENSATED CAM DESIGN TECHNIQUES Ph.D. Thesis
Michael Paul Thompson 1976 166 p
Avail: Univ. Microfilms Order No. 76-18951

An historical background is first given to describe classic cam profiles and to discuss conceptual guidelines and techniques which were developed as dynamic loads and thus resonant vibrations increased. New cam design techniques are then developed. The first uses intuitive feel for the valve train and its response to alter the basic Polydyne polynomial and then proceeds with the rest of the cam design in the same manner as the Polydyne technique. The second is based entirely upon mathematical modification of the Polydyne technique and results in a second operating speed with zero valve train resonant vibration. The techniques are then applied to a specific engine. Both the theoretical and experimental valve train resonant vibrations are less with the new cam design techniques than with the Polydyne technique. All three profiles compared favorably with the stock

cam profile for the specific engine used. Because of the simplicity of the model used and the complex nature of an engine valve train several sources of experimental error were identified.
Dissert. Abstr.

N76-30562 Ohio State Univ., Columbus.
INTERACTIVE CONTROL OF A SIX-LEGGED VEHICLE WITH OPTIMIZATION OF BOTH STABILITY AND ENERGY Ph.D. Thesis
David Edward Orin 1976 222 p
Avail: Univ. Microfilms Order No. 76-18019

The design of an interactive control system for a six-legged vehicle is discussed. The task of controlling the vehicle is divided between a human operator and a control computer. The operator solves some of the more difficult control problems such as speed, route, and mode selection. The control computer accepts these higher level commands from the operator and generates the joint angles, rates, and bias torques so as to achieve the desired body trajectory. The control computer is furnished with algorithms that generate the joint angles and rates with optimization of stability, while automatically adapting to terrain variation. These algorithms include automatic body height, pitch, and roll regulation, gait implementation, and automatic leg positioning.
Dissert. Abstr.

N76-30563 Wisconsin Univ., Madison.
IDENTIFICATION AND ANALYSIS OF MACHINE TOOL SYSTEM DYNAMICS UNDER ACTUAL WORKING CONDITIONS USING TIME SERIES METHODS Ph.D. Thesis
Farhat Ali Burney 1976 221 p
Avail: Univ. Microfilms Order No. 76-15981

The identification and analysis of machine tool system dynamics under actual working conditions is useful for the purpose of chatter control, acceptance testing, design evaluation, etc. Due to the stochastic and time-dependent nature of machine tool vibrations, a new time series technique was used for the purpose of such an analysis. The technique develops a statistically adequate mathematical model of the system under a given condition from data collected from the system. Cutter-workpiece relative vibration and cutting force data from a vertical milling machine were monitored during face-milling operations carried out under different cutting conditions. A new type of force transducer was employed for collecting the tangential cutting force signal. Conventional tests, such as the frequency response tests for ascertaining the dynamics of machine tool structure, were also undertaken for the purpose of comparing the results of the new technique. Dissert. Abstr.

N76-30564*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
COMPUTERIZED ADAPTIVE CONTROL WELD SKATE WITH CCTV WELD GUIDANCE PROJECT Status Report
W. A. Wall Aug. 1976 46 p refs
(NASA-TM-X-73328) Avail: NTIS HC $4.00 CSCL 13H

This report summarizes progress of the automatic computerized weld skate development portion of the Computerized Weld Skate with Closed Circuit Television (CCTV) Arc Guidance Project. The main goal of the project is to develop an automatic welding skate demonstration model equipped with CCTV weld guidance. The three main goals of the overall project are to: (1) develop a demonstration model computerized weld skate system, (2) develop a demonstration model automatic CCTV guidance system, and (3) integrate the two systems into a demonstration model of computerized weld skate with CCTV weld guidance for welding contoured parts. Author

N76-30565*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CERAMIC THERMAL-BARRIER COATINGS FOR COOLED TURBINES
Curt H. Liebert and Francis S. Stepka 1976 14 p refs Presented at 12th Propulsion Conf., Palo Alto, Calif., 26-29 Jul. 1976; sponsored by AIAA and SAE
(NASA-TM-X-73426; E-8766) Avail: NTIS HC $3.50 CSCL 21E

Coating systems consisting of a plasma sprayed layer of zirconia stabilized with either yttria, magnesia or calcia over a thin alloy bond coat have been developed, their potential was analyzed and their durability and benefits evaluated in a turbojet engine. The coatings on air cooled rotating blades were in good condition after completing as many as 500 two-minute cycles of engine operation between full power at a gas temperature of 1644 K and flameout, or as much as 150 hours of steady state operation on cooled vanes and blades at gas temperatures as high as 1644 K with 35 start and stop cycles. On the basis of durability and processing cost, the yttria stabilized zirconia was considered the best of the three coatings investigated.
Author

N76-30566# Oak Ridge National Lab., Tenn.
DIRECT BRAZING OF CERAMICS, GRAPHITE, AND REFRACTORY METALS
D. A. Canonico, D. A. Cole, and G. M. Slaughter Mar. 1975 20 p refs
(Contract W-7405-eng-26)
(ORNL-TM-5195) Avail: NTIS HC $5.00

The philosophy and techniques employed in the development of brazing filler metals for joining ceramics, graphite, and refractory metals for application at temperatures above 1000 C are presented. A number of compositions are discussed that have been satisfactorily used to braze ceramics, graphite, and refractory metals without a prior surface treatment. One alloy, Ti-25 percent Cr-21 percent V, has wet and flowed on aluminum oxide and graphite. Further, it has been utilized in making brazes between different combinations of the three subject materials. The excellent flowability of this alloy and alloys from the Ti-Zr-Ge system is evidenced by the presence of filler metal in the minute pores of the graphite and ceramics. Author (NSA)

N76-30567# Princeton Univ., N.J. Plasma Physics Lab.
LOW NOISE CONTROL VALVE
R. S. Christie 1975 16 p Presented at IEEE 6th Symp. on Eng. Probl. of Fusion Res., San Diego, Calif., 17 Nov. 1975
(Contract E(11-1)-3073)
(CONF-751125-127) Avail: NTIS HC $3.50

From IEEE 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975). Noise is one of the problems associated with the use of any type of control valve in systems involving the flow of fluids. The advent of OSHA standards has prompted control valve manufacturers to design valves with special trim to lower the sound pressure level to meet these standards. A type of fluid control device is described presently being used at PPL as a bypass control valve in deionized water systems and designed to reduce sound pressure levels considerably below OSHA standards. Details of the design and construction of this constant pressure drop variable flow control valve are presented and shown in photographs and drawings. Test data are included. Author (NSA)

N76-30568# Oxford Univ. (England). Dept. of Engineering Science.
A REGENERATIVE COMPRESSOR
H. Sixsmith and H. Altmann Oct. 1975 95 p refs Sponsored by Sci. Res. Council
(OUEL-1139/75) Avail: NTIS HC $5.00

A regenerative of peripheral compressor was developed with aerodynamic blading in place of the usual straight radial vanes on the rotor. The blades are shrouded by a core around which a helical toroidal flow path is established. Two compressors were constructed, the first with a single row of blades and the second with two rows side by side to provide parallel counter-rotating flow paths. The steep output characteristics resemble those of a Roots blower with isothermal efficiency reaching a maximum of 58 % at a low pressure ratio and falling as the pressure ratio increases. Suggestions based on the experience gained from these compressors are aimed at improving the efficiency of the machine, especially at high pressure ratios.
Author (ESA)

N76-30569# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
EFFECTS OF VARIATION IN DRAWBAR HITCH LOCATION ON VEHICLE PERFORMANCE
Ben Hanamoto Sep. 1975 21 p refs
(DA Proj. 1G6-62601-AH-1)
(AD-A016911; CRREL-SR-237) Avail: NTIS CSCL 13/6

The drawbar hitch point location has a direct effect on the trim attitude of a vehicle and influences the net pull developed by a vehicle during a drawbar pull test. The relationship of sinkage and slip a factor which cannot be neglected in the analytical evaluation of vehicle performance is examined. The equations relating sinkage, resistance, trim angle and the traction are developed. Modifying the drawbar pull test, by locating the tow hitch point at ground level thus eliminating the trim attitude caused by the rearward shift of the center of pressure beneath the contact area is considered. GRA

N76-30570# Cushing (C. R.) and Co., N. Y.
A STUDY OF INTERMODAL CONTAINER SAFETY Final Report
C. R. Cushing, M. L. Higgins, and P. B. Kimball Dec. 1975 261 p refs
(Contract DOT-CG-42356-A)
(AD-A021928; USCG-D-22-76) Avail: NTIS CSCL 13/14

As a result of the International Convention for Safe Containers (CSC), in 1972, the U.S. Coast Guard, which will be responsible for implementing and monitoring a rational and effective program in the United States when the Convention becomes international law, has undertaken through this study to investigate the existing levels of safety to humans and property engaged in the multimodal transport of containerized cargo. A major conclusion is that the excellent safety record heretofore enjoyed by the container industry is continuing throughout the increasing development of containerization. The commercial environment to which containers are exposed is investigated in terms of the sea, highway and rail transport modes as well as the various handling modes within and between terminals to determine if damages which are sustained by containers substantially affect their structural integrity on either an immediate or long-term basis. GRA

N76-30571# Michigan Univ., Ann Arbor. Highway Safety Research Inst.
FACTORS INFLUENCING THE EFFECTIVENESS OF AUTOMOTIVE REAR LIGHTING SYSTEMS
Paul L. Olson, Craig M. Jorgeson, Samuel P. Sturgis, J. Kirby Thomas, and Patricia A. Domas 31 Oct. 1975 111 p refs Prepared in cooperation with Motor Vehicle Manufacturers Assoc. of the US, Detroit, Mich.
(PB-252270/4; UM-HSRI-HF-75-4) Avail: NTIS HC $5.50 CSCL 13F

Rear lighting problem areas are discussed as follows: (1) The effect of rear lighting configurations on vehicle traffic flow characteristics, (2) the value of rear lamp shielding, (3) a review of the literature concerning the effects of alcohol and other drugs upon color perception, (4) the incidence of fog, rain, snow, and sunlight in various regions of the United States, and (5) a subjective evaluation of turn signal effectiveness.

N76-30572# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
FINITE ELEMENT ANALYSIS OF SPOTWELDED, BONDED AND WELD BONDED LAP JOINTS Final Report
Richard A. Mitchell, Ruth M. Woolley, and Saul M. Baker Dec. 1975 25 p refs
(PB-250769/7; NBSIR-75-957) Avail: NTIS HC $3.50 CSCL 13E

Finite element computer analyses of single-lap and double-lap structural joints are described. A planform analysis articulates the in-plane deformation of the joined sheet material and the lap-shear stresses acting through the spotwelds and/or adhesive. A longitudinal cross-section analysis computes out-of-plane bending effects, particularly important in single-lap joints, and adhesive peel stresses. Numerical results are presented that suggest a reasonable degree of mutual consistency between the planform analysis and the cross-section analysis. Although the basic finite element formulation is linear, nonlinear deformation can be simulated by a series of linear solutions. The computer output includes contour plots of stress and strain fields and exaggerated-scale plots of displacements. GRA

N76-30573# Naval Underwater Systems Center, New London, Conn.
THE CABLE DEVELOPMENT PROGRAM FOR SUSPENDED SENSOR APPLICATIONS Summary Report, FY 1971 - FY 1975
Richard C. Swenson 22 Sep. 1975 163 p refs
(NUSC Proj. A-628-00)
(AD-A020474; NUSC-TR-4915) Avail: NTIS CSCL 13/10

This report describes the progress of the NAVFAC sponsored cable development program for suspended sensor applications from FY-1971 through FY-1975. It delineates the technology developed and provides information that can guide component selection for other suspended cable applications. The major objective of the program was to demonstrate the feasibility of a new technology developed explicitly for suspended sensor systems in the ocean. Although the principal emphasis was placed on the major component - the cable - the technology was developed from an overall point of view for the entire system. The report describes electromechanical cable developments in steel and synthetic strength members; cable construction; fairing; buoyancy; acoustic sensors; special electrical conductors; insulation molding and bonding; array design, fabrication, and testing; complete dynamic and stress analysis of a suspended system; and sea usage to date, which has demonstrated the advantages of the newer technology and lighter weight systems. Author (GRA)

N76-30574# Naval Ship Research and Development Center, Bethesda, Md. Ship Performance Dept.
DESIGN AND EVALUATION OF A TOWED ac MAGNETIC SOURCE VEHICLE
Charles W. Sieber Jan. 1975 12 p
(AD-A021132; SPD-487-06) CSCL 13/10

An economical towed vehicle to provide a stable platform for an ac magnetic source at a speed of 4 knots and depth of 300 feet is designed and evaluated in at-sea experiments. The vehicle towed satisfactorily over the designed speed range and achieved the design objective. GRA

N76-30575# Sikorsky Aircraft, Stratford, Conn.
THE 3,000-HP ROLLER GEAR TRANSMISSION DEVELOPMENT PROGRAM. VOLUME 2: DESIGN REPORT Final Report
G. F. Gardner and J. Kish Dec. 1975 379 p refs
(Contract DAAJ02-69-C-0042; DA Proj. 1G1-62207-AA-72)
(AD-A020327; UTRC/S611675-Vol-2;
USAAMRDL-TR-73-98-Vol-2) Avail: NTIS CSCL 13/9

The development of the roller gear drive indicated potential gains in the overall operational efficiency of turbine-powered helicopters. This report presents the design effort involved in the development of the Sikorsky S-61 roller gear transmission. The roller gear drive is a combination of the roller transmission, which transmits power through friction, and a conventional geared planetary arrangement. This report covers the initial design of the S-61 roller gear transmission wherein the number of reduction stages, their locations and the reduction ratio of the roller gear unit are determined. Various types and layouts of transmissions are discussed. The finalized layout, which receives 3,700 hp from twin turbines and transmits 3,000 hp to the main rotor, incorporates a 19.85 L roller gear unit as the final stage in a three-stage reduction transmission. The detail design of the major components is discussed, and a stress analysis is presented in the appendixes. A calculated efficiency of 98.9% for the roller gear unit and 96.5% for the transmission is comparable to high-reduction-ratio transmissions of conventional design. Dynamic testing of the transmission will be conducted during later phases of the program whereby the efficiency of the transmission will be measured. Author (GRA)

N76-30576# IIT Research Inst., Chicago, Ill.
FINITE ELEMENT ANALYSIS OF AUTOMOTIVE STRUCTURES UNDER CRASH LOADINGS. VOLUME 2: TECHNICAL REPORT Final Technical Report, 30 Jun. 1973 - 30 Jun. 1975
R. E. Welch, R. W. Bruce, and T. Belytschko Mar. 1976 159 p refs 2 Vol.
(Contract DOT-HS-105-3-697)
(PB-251610/2; IITRI-J6321-FR-Vol-2; DOT-HS-801-847) Avail: NTIS HC $6.75 CSCL 13F

For abstract, see vol. 1.

N76-30577# IIT Research Inst., Chicago, Ill.
FINITE ELEMENT ANALYSIS OF AUTOMOTIVE STRUCTURES UNDER CRASH LOADINGS. VOLUME 1: SUMMARY Final Summary Report, 30 Jun. 1973 - 30 Jun. 1975
R. E. Welch, R. W. Bruce, and T. Belytschko Mar. 1976 24 p refs 2 Vol.
(Contract DOT-HS-105-3-697)
(PB-251609/4; IITRI-J6321-SR-Vol-1; DOT-HS-801-846) Avail: NTIS HC $3.50 CSCL 13F

A finite element computer program for use in the dynamic analysis of vehicle structures, including sheet metal, in a crash environment was developed. The following major tasks were involved: a technique for the finite element analysis of the dynamic response of plate beam structures involving very large displacements and rotations and elastic plastic material behavior was devised, and a computer program was developed incorporating the procedure for beam and plate elements and rigid links together with appropriate time integration procedures and material property descriptions. GRA

N76-30578# Rohr Industries, Inc., Chula Vista, Calif.
DESIGN, FABRICATION AND TEST OF AN AERODYNAMIC TORQUE CONVERTER Final Report, 15 Oct. 1970 - 15 Nov. 1975
James L. Myers, Jack J. Edwards, and Charles C. Hill Dec. 1975 133 p refs
(Contract F33615-71-C-1078; AF Proj. 3145)
(AD-A022705; AFAPL-TR-76-6) Avail: NTIS CSCL 01/3

An Aerodynamic Torque Converter (ATC) using an axial configuration has been designed, built and tested for use in an advanced gas turbine auxiliary power system. The ATC, which resembles hydraulic torque converters in principle of operation, uses a compressible fluid as the working media instead of an incompressible liquid. A portion of the auxiliary engine compressor discharge air is circulated to the ATC and returned to the gas turbine cycle at a higher temperature. This eliminates the need for a heat exchanger to remove transmission losses and returns the losses regeneratively to the gas turbine cycle. The ATC for this application was designed to transmit 280 hp at 82,000 rpm with peak efficiency of 80 percent at a speed ratio of 1:1. Due to mechanical difficulties with the input drive system, testing was completed at 57,000 rpm and at reduced pressure. The maximum measured efficiency was 68.5 percent at an input power of 87 HP. Design details and test results are presented. Author (GRA)

N76-30579# Catholic Univ. of America, Washington, D.C. Dept. of Mechanical Engineering.
DYNAMICS OF CABLE SYSTEMS Final Report
Mario J. Casarella Aug. 1975 14 p refs
(Contract N00014-68-A-0506-0001; NR Proj. 386-500)
(AD-A022119) Avail: NTIS CSCL 13/10

This report presents a summary of the accomplishment of the research program on the dynamics of wire ropes and cable systems. The master plan of research is discussed along with a complete list of the publications resulting from the investigation. GRA

N76-30580# SKF Industries, Inc., King of Prussia, Pa. Research Lab.
SURFACE ENDURANCE AND LUBRICATION OF SILICON NITRIDE BALL BEARINGS Final Report, Nov. 1974 - Nov. 1975
H. Dalal, D. Hahn, and N. Ninos Dec. 1975 81 p refs
(Contract N00019-75-C-0216)
(AD-A022157; SKF-AL75T030) Avail: NTIS CSCL 13/9

A report is made on the effect of using silicon nitride balls on the rolling contact fatigue life of radially loaded M50 steel ball bearings. Scanning electron microscope (SEM) examination of the surface topography of as-manufactured silicon nitride ball surfaces is described and compared with silicon nitride ball and flat washer surfaces tested previously. The rolling contact fatigue performance of previously tested all-tool-steel bearings is compared with the present group of bearings containing silicon nitride balls as well as with previously tested silicon nitride flat washers run against tool steel rollers. It is shown that the life of the present group of bearings is controlled by the life of the currently available silicon nitride ball complement. This is contrary to the previous flat washer life results. The ball groove surfaces of the present steel bearing rings after running against the silicon nitride balls are described. GRA

N76-30581# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.
DESIGN, FABRICATION, AND EVALUATION OF GATORIZED (TM) CERAMIC-WROUGHT ALLOY ATTACHMENT CONCEPTS Status Report, 1 Jul. 1974 - 31 Dec. 1975
W. D. Carruthers and Bryant H. Walker 31 Dec. 1975 94 p
(Contract N00019-74-C-0484)
(AD-A022158; PWA-FR-7419; SR-6) Avail: NTIS CSCL 13/8

Pratt and Whitney Aircraft (P and WA) has devised an attachment approach using P and WA's GATORIZING (TM) forging process which uses the superplastic characteristics, induced during the GATORIZING process, on selected nickel base superalloys to forge a disk around a ceramic blade root. With this attachment approach, localized stress concentrations on the ceramic are minimized by the low flow stress during forging, inherent in the GATORIZING process. The program was devised to develop and demonstrate the feasibility of a small gas turbine engine hybrid rotor with a superalloy disk and ceramic simulated blades, using the aforementioned attachment concept. The first task was to conduct a design study of selected candidate attachment concepts. Primary candidates were then reduced to practice on a sample basis to establish optimum fabrication techniques, process parameters, ceramic stability during fabrication, and the load carrying capability of the attachment. Attachment concepts were evaluated in an iterative manner until one GATORIZED (TM) ceramic-wrought superalloy attachment was successfully fabricated and demonstrated an ability to carry acceptable tensile loads. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N76-30582 General Electric Co., Philadelphia, Pa. Dept. of Reentry Systems.
QUALITY ASSURANCE SOLDERING GUIDE
M. Pratowski 1965 88 p
Copyright. Avail: General Electric, Philadelphia, Pa. HC $10.00

A soldering guide which presents a comprehensive study of the two soldering systems in use today is described. Over 124 illustrations covering recommended techniques and practices in soldering various types of terminals as well as printed circuit boards are included. A clear illustration in the initial stage of solder application, how to prepare the soldering iron, application of the heat sink and required tolerances and dimensions applicable to both systems are provided. Examples of acceptable/reliable and unacceptable/unreliable work which can serve as criteria for acceptance and rejection decisions are presented. In addition to these examples, a twenty-five point checklist is also included to round out the cycle and coverage of soldering operations. Author

N76-30583# Rockwell International Corp., Anaheim, Calif. Microelectronic Device Div.
THE MEASUREMENT OF CRITICAL DIMENSIONS ON PHOTOMASKS
Gunter W. Daberko May 1976 23 p refs Presented to Semicon 76-West Show, San Mateo, Calif., 26 May 1976
(X76-610/210) Avail: NTIS HC $3.50

Cause and effect of distorted image dimensions in measuring microscopes are examined and the value as well as the shortcomings of various calibration procedures are investigated. A new method that could be used to obtain more accurate line width measurements on chrome masks is described. This method may be incorporated in an improved calibration procedure which is designed to compensate for measuring errors incurred by optical

phenomena that affect the formation of images in microscopes.
Author

N76-30584# Svenska Radio A.B., Stockholm (Sweden).
BEAM LEAD BONDING INVESTIGATION (THICK FILM) Final Report
Jan Johansson 29 Aug. 1975 64 p refs
(Contract ESTEC-1823/72-HP)
(ESA-CR(P)-817) Avail: NTIS HC $4.50

The characteristics of beam-lead wobble bonded devices particularly considering their bond strength as a function of bond parameter settings were evaluated. A general survey regarding failure modes related to the bond process was carried out. A presentation is made of different bond strength test methods, bonding parameter optimization program and the results from an evaluation program on 4-beam devices bonded to thick film on ceramic substrates. Author (ESA)

N76-30585# Army Materiel Command, Alexandria, Va.
ENGINEERING DESIGN HANDBOOK: ENVIRONMENTAL STUDIES. PART 3: INDUCED ENVIRONMENTAL FACTORS
20 Jan. 1976 402 p refs
(AD-A023512; AMCP-706-117-Pt-3) Avail: NTIS CSCL 13/2

The handbook is the third in a series on the nature and effects of the environmental phenomena. As the title implies, the handbook addresses a set of induced environmental factors which comprise: (1) atmospheric pollutants; (2) sand and dust; (3) vibration; (4) shock; (5) acceleration; (6) acoustics; (7) electromagnetic radiation; (8) nuclear radiation. These particular factors were chosen as best representing the needs of the design engineer. It is recognized that this set is arbitrary and that natural forces contribute, sometimes in a major way, to these environmental parameters. The information is organized as follows: (1) description of the factor, its measurement, and its distribution; (2) description of the effects of the factor on materiel and the procedures for design so as to avoid or reduce adverse effects; (3) enumeration of the testing and simulation procedures that assure adequate design. GRA

N76-30586# Michigan Univ., Ann Arbor. Dept. of Mechanical Engineering.
IMPROVED ULTRASONIC NONDESTRUCTIVE TESTING OF PRESSURE VESSELS Annual Progress Report, 1 Aug. 1974 - 31 Jul. 1975
Julian R. Frederick, James A. Seydel, and Ronald C. Fairchild Jan. 1976 48 p refs
(Contract AT(11-1)-2488)
(PB-250381/1; NUREG-0007-1; NRC-5) Avail: NTIS HC $4.00 CSCL 14B

A new approach to ultrasonic imaging for use in the nondestructive testing of nuclear pressure vessels and piping is reported. The primary goal is to obtain improved resolution with respect to other NDT methods, and in this way to obtain a better idea of the size, shape, and orientation of a discontinuity in the pressure vessel or piping. Digital synthetic array processing was employed to realize lateral resolution on the order of one wavelength. High resolution B-scan presentations of artificial discontinuities in aluminum and RPV materials were displayed in several formats. Component specifications of the real time data acquisition system are included. GRA

N76-30587# Vanderbilt Univ., Nashville, Tenn.
PROBABILITY OF FLAW DETECTION FOR USE IN FRACTURE CONTROL PLANS Interim Report, Jun. 1973 - Dec. 1974
P. E. Packman, J. K. Mapini, and F. M. Wells 1976 22 p refs
(Contract F44620-73-C-0073; AF Proj. 9782)
(AD-A023042; AFOSR-76-0290TR) Avail: NTIS CSCL 14/2

Failure prediction techniques using fracture mechanics requires the knowledge of the presence, size and location of potential defects within the component under stress. The design techniques use the fact that a satifactory NDT inspection will screen out all flaws whose size would lead to premature failure within the component. The paper presents the results of a statistical study designed to determine the ability of several NDT methods to detect and identify small crack like defects. Three inspection procedures and materials were evaluated in a production inspection program: titanium penetrant, aluminum penetrant and steel magnetic particle inspection. The results were presented in terms of cumulative probability of detection; detection of flaws of a given size or larger, and range probability of detection, detection of flaws within a given size interval. The range detection results show that all three inspection procedures were capable of high sensitivity in detection of flaws whose size was greater than .080 inches in length. For flaws in the range 0.060 to 0.080 only the high resolution penetrants were able to find flaws to 95% at 90, 95 and 99% confidence levels. The relative ranking of the three inspection procedures are (1) titanium penetrant, (2) aluminum penetrant and (3) magnetic particle on high strength steel. Author (GRA)

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N76-30588 George Washington Univ., Washington, D.C.
FINITE ELEMENT ANALYSIS OF LAMINATED COMPOSITE PLATES AND SHELLS Ph.D. Thesis
Michael Douglas Mathers 1976 194 p
Avail: Univ. Microfilms Order No. 76-17138

A number of displacement and mixed finite element models are used to analyze laminated composite plates and shells. The analytical formulation is based on the Vlasov-Marguerre shallow shell theory, with the effects of geometric nonlinearity, transverse shear deformation, rotary inertia, material anisotropy, and bending-extensional coupling included. The finite element analysis is rendered more efficient by exploiting the symmetries exhibited by anisotropic plates and shells in the analysis. The effects of shear deformation and anisotropy on the linear and nonlinear response of composite plates and shells are studied. Numerical results are presented to assess the relative merits of the elements developed. Dissert. Abstr.

N76-30589 George Washington Univ., Washington, D.C.
LARGE DEFORMATIONS AND STABILITY OF COMPLEX STRUCTURES Ph.D. Thesis
Emad A. Akkoush 1974 122 p
Avail: Univ. Microfilms Order No. 76-15577

A procedure is developed for investigating the stability of complex structures that consist of an assembly of stiffened rectangular panels and three-dimensional beam elements. The stiffeners are treated as beam elements, and the panels between them as thin rectangular plate elements, which may be subject to membrane and/or bending and twisting actions. The main objective is the determination of the critical buckling loads and the generation of the complete force-deformation behavior of such structures within a specified load range based on the use of a computer program. The present formulation can trace through the postbuckling or postlimit behavior whether it is of an ascending or descending type. A limit load extrapolation technique is automatically initiated within the computer program, when the stability analysis of an imperfect or laterally loaded structure is being carried out. Dissert. Abstr.

N76-30590 Pennsylvania State Univ., University Park.
VIBRATION AND SOUND RADIATION OF A PLATE Ph.D. Thesis
Robert John Hannon 1975 117 p
Avail: Univ. Microfilms Order No. 76-17172

Plates of different shapes and dimensions were supported in such a way as to eliminate effects of the support on the vibration, and the velocity amplitudes due to point forces were recorded by phonograph cartridge and microphones in the near sound field. The results show that the many vibratory modes generate hotspots on the plates. The attachment of ribs and supports disturbs the vibration field and leads to localized areas of increased sound radiation. Long wavelength acoustic holography was used to locate on the vibrating plates the sources of far-field

sound. These regions were also investigated by recording the vibratory and nodal line patterns of the plates by a near-field microphone method. This combination of techniques has a unique capability to locate acoustic sources on vibrating structures.
Dissert. Abstr.

N76-30591 New Hampshire Univ., Durham.
WAVE PROPAGATION IN VISCOELASTIC MEDIA Ph.D. Thesis
Gary Kenneth Stewart 1975 275 p
Avail: Univ. Microfilms Order No. 76-18069

For a linear viscoelastic medium with the couple stresses the Green's function for an infinitely extended medium was examined and the wave propagation properties of the field discussed by studying the analytical structure of the Green's function. It was observed that the longitudinal wave propagation is unaltered, and that the transverse mode undergoes a change (due to couple-stresses) with an appropriate wave number; and an overdamped propagation mode is further modified due to viscoelastic effects. The consistency of the results was checked for various special cases. The problem of acoustic subbottom sediment identification and classification was also examined. Expressions were developed for the acoustic response in a liquid halfspace overlying a multilayered halfspace consisting of viscoelastic soil and viscous fluid layers. The multilayered problem was solved using the Green's function formalism, integral transforms and by matching boundary conditions at each interface between layers. Dissert. Abstr.

N76-30592 Kansas State Univ., Manhattan.
THERMAL SHOCK ON AN ORTHOTROPIC CYLINDRICAL SHELL OF FINITE LENGTH DUE TO AN INSTANTANEOUS POINT HEAT SOURCE Ph.D. Thesis
Hua-Kawi Woo 1975 173 p
Avail: Univ. Microfilms Order No. 76-17127

An analytical solution is presented for the transient temperature and the associated thermal stresses and deformations which arise in an orthotropic cylindrical shell of finite length loaded by an instantaneous point heat source. The problem is approached from the standpoint of classical linear, uncoupled, quasi-state thermoelastic theory. The material of the shell is assumed to be homogeneous and orthotropic with respect to both its thermal and mechanical response, and its physical properties are assumed to be independent of temperature. The linear variation of the temperature through the thickness of the shell is assumed. Two uncoupled equations of heat conduction are solved for the infinitely long shell by using transform calculus. Dissert. Abstr.

N76-30593 Pennsylvania State Univ., University Park.
FRACTURE TOUGHNESS ANALYSIS OF PLATE CONTAINING SURFACE CRACKS UNDER CERTAIN CONDITIONS OF TEMPERATURE AND LOADING Ph.D. Thesis
Farouk Mohamed Bahgat 1975 231 p
Avail: Univ. Microfilms Order No. 76-17143

The J-integral approach was applied to plates containing straight and surface flaws types of cracks subjected to uni- as well as biaxial loading at room and higher temperatures. The experimental procedure was based on a proposed method by Begley and Landes which utilizes a resistance R type curve to establish a fracture criterion in metals. In the proposed method, a critical value of J for specimens with straight through-the-width cracks was defined in terms of the linear increase in the crack depth. This procedure was modified to consider the incremental extension of the crack-tip area due to static loading. An interpolation process was also used for estimating average values of Jc for crack geometries which lie between those obtained experimentally. A general expression for the average fracture toughness Kc was then formulated in terms of three independent functions. Dissert. Abstr.

N76-30594 Columbia Univ., New York.
PROPERTIES OF OPTICAL GUIDED WAVES PROPAGATING IN LOSSY STRUCTURES Ph.D. Thesis
Axel Robert Reisinger 1976 126 p
Avail: Univ. Microfilms Order No. 76-18477

A number of analysis techniques aimed at determining the characteristics of optical guided waves propagation in lossy structures are examined. The exact theory is used as a guide to assess the validity of several approximate techniques based on two approaches: (1) geometrical optics and (2) perturbation calculations. The limitations of the conventional perturbation techniques are specified. A general procedure is presented which permits an adequate description of metal boundaries at optical frequencies. Loss measurements carried out in liquid waveguides bounded on one side by a conducting wall show that attenuation coefficients vary with mode order N as (N+1)2 and with waveguide thickness w as w-3, in agreement with theory. Experimental results also tend to point toward the same behavior for losses due to surface scattering. Dissert. Abstr.

N76-30595 Iowa State Univ. of Science and Technology, Ames.
NONLINEAR ANALYSIS OF REINFORCED CONCRETE BEAMS, BEAM-COLUMNS AND SLABS BY FINITE ELEMENTS Ph.D. Thesis
Kadambi Ramaswami Rajagopal 1976 185 p
Avail: Univ. Microfilms Order No. 76-18288

A static nonlinear analysis of reinforced concrete beams, beam columns and slabs by finite elements is reported. Loads are incremented monotonically in small increments, and corrective iterations within the increments are performed until equilibrium convergence is achieved. With increasing loads theoretical information regarding the load deflection response of the structures, cracking and crushing of the concrete, yielding of the reinforcement steel and the collapse loads becomes available. The analysis uses a layered approach to account for the varying material properties over the depth of the finite element.
Dissert. Abstr.

N76-30596 Illinois Inst. of Tech., Chicago.
NONLINEAR VIBRATION OF CABLE TRUSSES Ph.D. Thesis
Sharad Hari Mote 1975 62 p
Avail: Univ. Microfilms Order No. 76-13165

This study concerned the vibration of cable trusses consisting of a top cable curved up, a bottom cable curved down and connected with diagonal members. The stiffness method was used in the analysis. The dynamic problem was solved by considering mass and moment of inertia equal to that of half of the length of the member as concentrated at the connected joint (real or imaginary). A linear acceleration method was used which resulted in modifying the mass matrix and the load matrix at each time increment. The unbalanced force was reduced to tolerable limit before starting the next time step. Further modification of mass and stiffness matrix was necessary for the case of moving loads. The method was proved accurate if a suitable time step was taken. The static solution was verified by examples from the literature. The dynamic analysis was checked with a cable solution, then the truss was subjected to periodic and earthquake loads. Dissert. Abstr.

N76-30597 Connecticut Univ., Storrs.
VISCOUS EFFECTS IN ONE-DIMENSIONAL CONSOLIDATION Ph.D. Thesis
Guruswami Siddhan 1976 140 p
Avail: Univ. Microfilms Order No. 76-19000

Stress level as a parameter is introduced into the hyperbolic law based on rate process theory which describes the dash-pot element in the rheological model. The effects of parameters M, A, and Q which are functions of thickness, load increment ratio, and load increment durations on the compression behavior and pore water pressure responses are discussed. The introduction of initial viscous shear stress as parameter Q essentially explains the separate strain paths followed and different pore water pressures observed in identical tests after different load increment durations. The introduction of stress level into the law describing dash-pot element is found to keep the viscosity parameters essentially constant over a wide range of stress levels. A method to compute the various parameters in the rheological consolidation model from laboratory one-dimensional consolidation tests is also presented. Experimental results at different temperatures on kaolin and the viscosity parameters for varved clay are given.
Dissert. Abstr.

N76-30598 Virginia Polytechnic Inst. and State Univ., Blacksburg.
INTERLAMINAR STRESSES IN COMPOSITE LAMINATES-A PERTURBATION ANALYSIS Ph.D. Thesis

Peter Wenham Hsu 1976 106 p
Avail: Univ. Microfilms Order No. 76-17097

A general method of solution for an elastic balanced symmetric composite laminate subject to a uniaxial extension was developed based upon a perturbation analysis of a limiting free body containing an interfacial plane. The solution satisfies more physical requirements and boundary conditions than previous investigations, predicts smooth continuous interlaminar stresses with no instabilities, determines the finite maximum intensity for the interlaminar normal stress in all laminates, provides mathematical evidences for the singular stresses in angle-ply laminates, suggests the need for the experimental determination of an important problem parameter, and introduces a viable means for solving related problems of practical interest. The results for bi-directional laminates compare favorably with Pipes' finite difference solution. Dissert. Abstr.

N76-30599 George Washington Univ., Washington, D.C.
AN ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF THE EDGE-SLIDING MODE IN FRACTURE MECHANICS Ph.D. Thesis
Douglas Blanchard Chisholm 1975 216 p
Avail: Univ. Microfilms Order No. 76-15578

A boundary collocation method was applied in determining the stress intensity factors for a pair of through-the-thickness, traction-free cracks in a finite isotropic plate. The crack tip stress and deformation fields were shown to be those of the edge-sliding mode. An elastostatic analysis was carried out in terms of the complete Williams' stress function employing both even and odd components. The boundary conditions for the compact tension specimen were applied in order to validate the solution obtained using the even components of the stress function, and those for the antisymmetric case were employed to validate the solutions obtained using the odd stress function components. Due to the absence of previous analytical solutions for asymmetric loading of a dual edge-cracked plate involving both even and odd stress function components, a photoelastic experiment was conducted. Dissert. Abstr.

N76-30600 State Univ. of New York, Stony Brook.
DEFORMATION MEASUREMENT ON CURVED SURFACES Ph.D. Thesis
Ren Ming Jung 1976 137 p
Avail: Univ. Microfilms Order No. 76-18733

The measurements of deflection and slope of curved surfaces are studied by using some grating related methods and speckle interferometry technique. Three grating related methods, namely the shadow moire method, the Ligtenberg reflective moire method, and the direct-grating method are extended to the application to curved surfaces through the use of a periphery camera. The modified arrangement of each technique is described and tested on a circular cylindrical shell under two equal and opposite radial concentrated loads. The resulting fringe patterns showing contour lines are compared with theoretically obtained ones and are in very good agreement. A new laser speckle interferometry method is developed to yield partial slope fringes, via a double exposure technique, by utilizing the speckles created in front of a surface illuminated by a laser. Dissert. Abstr.

N76-30601 North Carolina State Univ., Raleigh.
AN EXPERIMENTAL INVESTIGATION OF LATE-STAGE EQUIVALENCE FOR THE AXIAL HYPO-AND HYPERVELOCITY IMPACT OF RODS Ph.D. Thesis
James Jerrold Kelly 1975 96 p
Avail: Univ. Microfilms Order No. 76-17252

The development is described of a diffraction-grating strain-measurement system capable of measuring axial surface strains in target rods experiencing axial hypo- and hypervelocity impact and its subsequent application to evaluate the existence of the late-stage equivalence principle for this impact configuration. From an analysis of the material-point strain histories collected from long, polycarbonate target rods axially impacted by equal diameter, short polycarbonate projectiles traveling at velocities from 10,980 ft/sec to 15,476 ft/sec, it was concluded that: (1) late-stage equivalence does exist for target configurations other than the previously investigated semi-infinite solid case, and (2) the value of the exponent alpha in the scaling law L sub o V sub o alpha = L sub 1 V sub 1 alpha was determined to be 1.32 for the target configuration of this investigation. Dissert. Abstr.

N76-30602 State Univ. of New York, Buffalo.
ELASTICITY SOLUTION FOR THE DYNAMIC RESPONSE OF AN INITIALLY STRESSED RECTANGULAR PLATE Ph.D. Thesis
Hui-Han Liu 1976 94 p
Avail: Univ. Microfilms Order No. 76-17031

An initially stressed rectangular plate is subjected to a transverse, time dependent load. The initial stress field is constant and parallel to the x-axis and the transverse load is uniformly distributed over a rectangular area, the sides of which are parallel to the side of the plate. The problem is formulated within the framework of classical three-dimensional elasticity theory, and an exact solution is obtained in series form. The solution is compared to the known corresponding solutions for approximate plate theories. The case of static stability under pre-stress is also considered. Dissert. Abstr.

N76-30603*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CONCORDE NOISE-INDUCED BUILDING VIBRATIONS, SULLY PLANTATION - REPORT NO. 2, CHANTILLY, VIRGINIA
Jun. 1976 46 p refs
(NASA-TM-X-73926; Rept-2630) Avail: NTIS HC $4.00 CSCL 13M

Noise-induced building vibrations associated with Concorde operations were studied. The approach is to record the levels of induced vibrations and associated indoor/outdoor noise levels in selected homes, historic and other buildings near Dulles International Airport. Representative data are presented which were recorded at Sully Plantation, Chantilly, Virginia during the periods of May 20 through May 28, 1976, and June 14 through June 17, 1976. Recorded data provide relationships between the vibration levels of windows, walls, floors, and the noise associated with Concorde operations, other aircraft, and nonaircraft events. The results presented are drawn from the combined May-June data base which is considerably larger than the May data base covered. The levels of window, wall and floor vibratory response resulting from Concorde operations are higher than the vibratory levels associated with conventional aircraft. Furthermore, the vibratory responses of the windows are considerably higher than those of the walls and floors. The window response is higher for aircraft than recorded nonaircraft events and exhibits a linear response relationship with the overall sound pressure level. For a given sound pressure level, the Concorde may cause more vibration than a conventional aircraft due to spectral or other differences. However, the responses associated with Concorde appear to be much more dependent upon sound pressure level than spectral or other characteristics of the noise. Author

N76-30604# Polish Academy of Sciences, Warsaw.
DISCRETIZATION OF A RECTANGULAR PLATE USING THE METHOD OF FINITE ELEMENTS [DYSKRETYZACJA TARCZY PROSTOKATNEJ METODA ELEMENTOW SKONCZONYCH]
Janina Ostrowska-Maciejewska, Jacek Bauer, and Romuald Kotowski 18 Nov. 1975 44 p refs In POLISH
Avail: NTIS HC $4.00

In connection with the development of new methods of statistical calculations of multistory large-plane structures for apartment construction, an analysis of the basic wall-element as a plate structure is conducted. A rectangular plate with sixteen degrees of freedom, each with two kinematic degrees of freedom in eight pairs, is studied. As kinematic pairs, apexes and center points of the plate sides are chosen. On the principle that the function of the shape is a serendipitous-quadratic family, a matrix of stiffness is determined for the plate. The matrix characterizes the deformation of the plate and makes it possible to obtain a solution for displacements. An example is studied in which the number of degrees of freedom is reduced to twelve as a result of the limitations which the condition of stiff-floors imposes on displacement of the wall plate. Author

N76-30605*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

FATIGUE-CRACK INITIATION AND GROWTH IN NOTCHED 2024-T3 SPECIMENS MONITORED BY A VIDEO TAPE SYSTEM

J. A. Sova (NAS-NRC), J. H. Crews, Jr., and R. J. Exton Washington Aug. 1976 33 p refs
(NASA-TN-D-8224; L-10754) Avail: NTIS HC $4.00 CSCL 11F

Fatigue-crack initiation and early stages of growth in notched 2024-T3 aluminum alloy sheet specimens were monitored during constant-amplitude fatigue tests conducted for a range of stress ratios. A video tape system was developed to detect fatigue cracks 0.1 mm in length on the sheet surface and to monitor their growth. Fatigue cracks initiated either at the notch corner or on the notch surface. Most of the first fatigue cracks started as notch-corner cracks, and the crack-initiation period was defined as the number of cycles for which the crack was 0.1 mm in length on the sheet surface. For each of the stress ratios used, the results showed that at the low stress levels, the crack-initiation period constituted at least 90 percent of the fatigue lives. However, for the negative stress ratios at the high stress levels, cracks started as early as at about 40 percent of the fatigue lives.
Author

N76-30606*# Lehigh Univ., Bethlehem, Pa.
THE CRACK-CONTACT AND THE FREE END PROBLEM FOR A STRIP UNDER RESIDUAL STRESS

M. Bakioglu and F. Erdogan Mar. 1976 22 p refs
(Grants NGR-39-007-011; NSF ENG-73-045053-A01)
(NASA-CR-145061) Avail: NTIS HC $3.50 CSCL 13M

The plane problem for an infinite strip with two edge cracks under a given state of residual stress is considered. The residual stress is compressive near and at the surfaces and tensile in the interior of the strip. If the crack is deep enough to penetrate into the tensile zone, then the problem is one of crack-contact problem in which the depth of the contact area is an unknown which depends on the crack depth and the residual stress profile. The problem has applications to the static fatigue of glass plates and is solved for three typical residual stress profiles. In the limiting case of the crack crossing the entire plate thickness, the problem becomes a stress-free end problem for a semi-infinite strip under a given residual stress state away from the end. This is a typical stress diffusion problem in which decay behavior of the residual stress near and the nature of the normal displacement at the end of the semi-infinite strip are of special interest. For two typical residual stress states the solution is obtained, and some numerical results are given. Author

N76-30607*# Lehigh Univ., Bethlehem, Pa.
CRACK PROPAGATION AND ARREST IN PRESSURIZED CONTAINERS

F. Erdogan, F. Delale, and J. A. Owczarek Mar. 1976 35 p refs
(Grants NGR-39-007-011; NSF ENG-73-045053)
(NASA-CR-145065) Avail: NTIS HC $4.00 CSCL 13M

The problem of crack propagation and arrest in a finite volume cylindrical container filled with pressurized gas is considered. It is assumed that the cylinder contains a symmetrically located longitudinal part-through crack with a relatively small net ligament. The net ligament suddenly ruptures initiating the process of fracture propagation and depressurization in the cylinder. Thus the problem is a coupled gas dynamics and solid mechanics problem the exact formulation of which does not seem to be possible. The problem is reduced to a proper initial value problem by introducing a dynamic fracture criterion which relates the crack acceleration to the difference between a load factor and the corresponding strength parameter. The results indicate that generally in gas filled cylinders fracture arrest is not possible unless the material behaves in a ductile manner and the container is relatively long. Author

N76-30608*# Lehigh Univ., Bethlehem, Pa.
CRACK PROBLEMS IN CYLINDRICAL AND SPHERICAL SHELLS

F. Erdogan Feb. 1976 57 p refs
(Grant NGR-39-007-011)
(NASA-CR-145066) Avail: NTIS HC $4.50 CSCL 13M

Standard plate or shell theories were used as a starting point to study the fracture problems in thin-walled cylindrical and spherical shells, assuming that the plane of the crack is perpendicular to the surface of the sheet. Since recent studies have shown that local shell curvatures may have a rather considerable effect on the stress intensity factor, the crack problem was considered in conjunction with a shell rather than a plate theory. The material was assumed to be isotropic and homogeneous, so that approximate solutions may be obtained by approximating the local shell crack geometry with an ideal shell which has a solution, namely a spherical shell with a meridional crack, a cylindrical shell with a circumferential crack, or a cylindrical shell with an axial crack. A method of solution for the specially orthotropic shells containing a crack was described; symmetric and skew-symmetric problems are considered in cylindrical shells with an axial crack. Y.J.A.

N76-30609*# Pennsylvania State Univ., University Park. Dept. of Engineering Science and Mechanics.
THE APPLICATION OF STRAIN RANGE PARTITIONING METHOD TO TORSIONAL CREEP-FATIGUE INTERACTION

S. Y. Zamrik 1 Oct. 1975 27 p refs
(Grant NGR-39-009-034)
(NASA-CR-134817) Avail: NTIS HC $4.00 CSCL 13M

The method of strain range partitioning was applied to a series of torsional fatigue tests conducted on tubular 304 stainless steel specimens at 1200 F. Creep strain was superimposed on cycling strain, and the resulting strain range was partitioned into four components; completely reversed plastic shear strain, plastic shear strain followed by creep strain, creep strain followed by plastic strain and completely reversed creep strain. Each strain component was related to the cyclic life of the material. The damaging effects of the individual strain components were expressed by a linear life fraction rule. The plastic shear strain component showed the least detrimental factor when compared to creep strain reversed by plastic strain. In the latter case, a reduction of torsional fatigue life in the order of magnitude of 1.5 was observed. Author

N76-30610# Commissariat a l'Energie Atomique, Le Barp (France).
SIMULATION OF MECHANICAL SHOCKS ENVIRONMENTS, VOLUME 1

C. Lalanne Jul. 1975 470 p In FRENCH
(CEA-R-4682(1)) Avail: ERDA Depository Libraries HC $26.50

Shocks can produce a severe mechanical environment which must be taken in account when designing and developing new equipment. After some mathematics, as Laplace and Fourier transforms, and mechanical revivals as response to a one degree of freedom system to a sinusoidal excitation, this paper shows and compares different analysis methods. These methods are used to compare relative severities of tests and to establish specifications. A few chapters are intended to establish different properties of simple, easy to produce shock shapes. Then some now-in-use shock-machine specifications are shown. A final chapter concerns acceleration transducers. Author (ERA)

N76-30611# Commissariat a l'Energie Atomique, Le Barp (France).
SIMULATION OF MECHANICAL SHOCKS ENVIRONMENTS, VOLUME 2

C. Lalanne Jul. 1975 694 p refs In FRENCH
(CEA-R-4682(2)) Avail: ERDA Depository Libraries HC $37.75

Shocks can produce a severe mechanical environment which must be taken in account when designing and developing new equipment. After some mathematics, as Laplace and Fourier transforms, and mechanical revivals as response of a one degree of freedom system to a sinusoidal excitation, this paper shows and compares different analysis methods. These methods are used to compare relative severities of tests and to establish specifications. A few chapters are intended to establish different properties of simple, easy to produce shock shapes. Then some now-in-use shock-machine specifications are shown. A final chapter concerns acceleration transducers. Author (ERA)

N76-30612# Oxford Univ. (England). Dept. of Engineering Science.
MINIMUM WEIGHT DESIGN OF COOLING TOWERS

J. K. W. To and W. S. Hemp 1975 19 p refs
(OUEL-1138/75) Avail: NTIS HC $3.50

The minimum weight design of cooling towers designed to withstand wind differential pressure of maximum value coming from winds with any compass bearings is considered on the basis of the following assumptions: (1) the tower is a shell of revolution made from a homogeneous material of thickness depending on a vertical coordinate z, with an allowable stress in tension and compression, (2)the ratio of the radius z sub zero at the top of the tower to the tower height h is prescribed, (3) the slope of the diverging part of the tower, as measured from the vertical, is restricted so as not to exceed the ratio 1/8, which is necessary to ensure the efficient functioning of the tower as a chimney, and (4) the strength of the tower is determined by the membrane stresses induced by wind pressures, etc. Results of the analysis are presented in graphical form and give the ratio of the base radius to the height as a function of r sub 0/h, V/p cu h, as a function of r sub 0/h, and the profile and thickness distributions for r sub 0/h = 0.1, 0.3, 0.5, 0.7, and 0.9. Author (ESA)

N76-30613# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.
A NUMERICAL DETERMINATION OF THE BENDING OF THIN CONICAL SHELLS UNDER NORMAL LOADING
D. H. Ferriss Feb. 1976 41 p refs
(NPL-NAC-63) Avail: NTIS HC $4.00

The equilibrium of thin conical shells under normal loading and various end conditions is formulated in terms of displacements. The partial differential equations and boundary conditions are such that Fourier expansion of the dependent variables enables the problem to be reduced to an eighth order system of ordinary differential equations which are solved in terms of Chebyshev series. Tables and graphs of results are presented, and comparison is made for one case with an analogous membrane solution. Author (ESA)

N76-30614# European Space Agency, Paris (France).
DESH, A SIMPLE SHALLOW TRIANGULAR SHELL ELEMENT
Klaus Rohwer et al Feb. 1976 35 p refs Transl. into ENGLISH of 'DESH, ein einfaches Schalenelem. ueber dreieckigem Grundriss', DFVLR, Brunswick Report DLR-Mitt-75-13, 22 Jul. 1975 Original German report available from DFVLR, Cologne DM 17
(ESA-TT-249; DLR-Mitt-75-13) Avail: NTIS HC $4.00

A triangular shell finite element compatible with the large general purpose structural element COSA computer program was developed. In the scope of the shallow shell theory, quadratic interpolation was used for five displacement functions. The degrees of freedom were placed at the edges and the middle of each side of the triangle. For test purposes the eigenvalues of the element stiffness matrix were examined. Also a disk, a plate, and a shell problem were analyzed. Author (ESA)

N76-30615# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
MEASUREMENT OF WIND LOADS ON LARGE-SCALE AIR-SUPPORTED SHELTERS
Richard Madden, Hugh A. Wright, Bruce E. Murray, Anthony R. Clemente, and James D. Blackwell May 1975 67 p refs
(Contract DAAG17-73-C-0264; DA Proj. 1T7-62723-AH-98) (AD-A020948; NDC-TR-75-101AMEL) Avail: NTIS CSCL 13/13

Wind tunnel tests on a double-wall and a single-wall air-supported shelter are described. Included is a description of the test facility, test items and instrumentation. The procedures used for data acquisition and reduction are discussed. Results are presented in terms of aerodynamic load coefficients, pressure distribution, anchor loads and spectra of the shelter acceleration and anchor loads. These results are compared with previous results obtained using models of air-supported shelters and with some rigid structure results. GRA

N76-30616# Army Materiel Command, Texarkana, Tex. Intern Training Center.
A DESIGN-AID AND COST ESTIMATE MODEL FOR SUPPRESSIVE SHIELDING STRUCTURES Final Report
Richard S. K. Pei Dec. 1975 124 p refs
(AD-A020508; USAMC-ITC-02-08-76-413) Avail: NTIS CSCL 13/12

A computer cost model of suppressive shielding structures has been constructed and is presented in the report. This model consists of design-aid and cost estimation programs which, with proper inputs, calculates and outputs specific design and cost variables of suppressive structures. Design variables include the following: venting coefficient, plastic bending and yield moments of beams, penetration of primary fragments, and the total effective thickness of plates. Cost output variables include: material, fabrication, welding, and total costs of panels, frame, door, and foundation of a cubical suppressive structure. A description of the model and its construction details are reviewed in the report. A user's guide which includes step by step instructions in data inputs is also provided. Author (GRA)

N76-30617# California Univ., San Diego. Dept. of Applied Mechanics and Engineering Sciences.
DYNAMIC RESPONSE OF THIN SHELLS TO SUDDENLY APPLIED LOADS Final Scientific Report, 1 Mar. - 31 May 1975
William Nachbar Dec. 1975 46 p refs
(Grant AF-AFOSR-2062-71; AF Proj. 9782)
(AD-A023130; AFOSR-76-0057TR) Avail: NTIS CSCL 20/11

Results of research are described for the following three principal program areas: (1) buckling and post-buckling analysis of thin shells; (2) stress-wave focusing effects in partially-transparent solids due to high-intensity, short-time heating by absorption of pulsed radiant energy; and (3) optimization problems for viscoelastic materials. Author (GRA)

N76-30618# California Univ., Berkeley. Earthquake Engineering Research Center.
AN ALTERNATIVE REPRESENTATION OF THE ELASTIC-VISCOELASTIC ANALOGY
Gautam Dasgupta and Jerome L. Sackman Dec. 1975 34 p refs
(PB-252173/0; EERC-75-40) Avail: NTIS HC $4.00 CSCL 20K

An alternative representation of the elastic-viscoelastic correspondence principle for solids similarly viscoelastic in bulk and shear, and subjected to steady-state harmonic excitation, is derived. The analyticity property of the frequency response function is utilized to formulate a Dirichlet problem in the lower half of the complex plane with the elastic solution on the real line as the boundary data. An infinite integral representation for the viscoelastic frequency response function is then obtained, where the elastic frequency reponse and viscoelastic properties enter in the integrand. This integral may be evaluated numerically using a suitable quadrature formula, and the known discrete numerical values of the elastic frequency response function, to generate an approximation to the viscoelastic frequency response function. GRA

42 GEOSCIENCES (GENERAL)

N76-30619*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
BASALT MODELS FOR THE MARS PENETRATOR MISSION: GEOLOGY OF THE AMBOY LAVA FIELD, CALIFORNIA
Ronald Greeley and T. E. Bunch Apr. 1976 56 p refs Prepared jointly with Univ. of Santa Clara, Santa Clara, Calif.
(NASA-TM-X-73125; A-6554) Avail: NTIS HC $4.50 CSCL 08G

Amboy lava field (San Bernardino County, California) is a Holocene basalt flow selected as a test site for potential Mars Penetrators. A discussion is presented of (1) the general relations of basalt flow features and textures to styles of eruptions on earth, (2) the types of basalt flows likely to be encountered on Mars and the rationale for selection of the Amboy lava field as a test site, (3) the general geology of the Amboy lava field, and (4) detailed descriptions of the target sites at Amboy lava field. Author

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N76-30620*# Federation of Rocky Mountain States, Inc., Denver, Colo.

A REGIONAL LAND USE SURVEY BASED ON REMOTE SENSING AND OTHER DATA Quarterly Report, 10 Apr. - 10 Jul. 1976

George Nez, Principal Investigator 10 Jul. 1976 31 p ERTS (Contract NAS5-22338)

(E76-10449; NASA-CR-148526; QR-5) Avail: NTIS HC $4.00 CSCL 08B

There are no author-identified significant results in this report.

N76-30621*# Direccion de Cartografia Nacional, Caracas (Venezuela).

DEVELOPMENT OF TECHNIQUES TO SIMPLIFY THE PROCESS OF INVESTIGATION AND ESTIMATE OF NATURAL RESOURCES IN REMOTE AND RELATIVELY UNEXPLORED AREAS, VENEZUELA Final Report

Adolfo C. Romero, Principal Investigator 1976 153 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(E76-10451; NASA-CR-148560) Avail: NTIS HC $6.75 CSCL 08F

The author has identified the following significant results. Based upon the results obtained by both interpretations, radar and satellite, highly fractured zones were outlined and checked against geologic rock samples. Most of the rock samples were collected along the Ventuari River that crosses most of the project area from NE to SE. The structural orientation and fracture patterns were taken into consideration during the planning of flight lines, also the magnetic declination of the area. Most of the flight lines were oriented N 30 deg W across known structural trends; the altitude above ground was 450 feet, and the distance between lines was 3000 feet. The ERTS image permits the obtention of a panoramic vision of the area, and facilitates the exact delineation of major drainages. Topographic changes are easily observed. Rocky outcrops are easily distinguishable on band 5 and 7. Shrub vegetation zones are distinguishable on both bands, without possible separation of forest types, this is possible only when the physiographic conditions of small textural differences are taken into account.

N76-30622*# National Marine Fisheries Service, Bay Saint Louis, Miss.

LANDSAT FOLLOW-ON EXPERIMENT: GULF OF MEXICO MENHADEN AND THREAD HERRING RESOURCES INVESTIGATION Progress Report, 1 May - 31 Jul. 1976

Kenneth J. Savastano, Principal Investigator, Andrew J. Kemmerer, Thomas D. Leming, Hillman Holley, and Kenneth Faller (NASA. Johnson Space Center) Aug. 1976 50 p refs ERTS (NASA Order S-54114)

(E76-10454; NASA-CR-148585; SEFC-Contrib-456; Rept-5) Avail: NTIS HC $4.00 CSCL 08A

The author has identified the following significant results. The most significant achievements realized thus far include the successful charting of high probability fishing areas from LANDSAT MSS data and the successful simulation of an operational satellite system to provide tactical information for the commercial harvest of menhaden.

N76-30623*# Corps of Engineers, Waltham, Mass.

OPERATION OF LANDSAT AUTOMATIC TRACKING SYSTEM

Saul Cooper, Principal Investigator and Timothy D. Buckelew Mar. 1976 73 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(E76-10455; NASA-CR-148586) Avail: NTIS HC $4.50 CSCL 17I

There are no author-identified significant results in this report.

N76-30624*# Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources.

INTERDISCIPLINARY APPLICATIONS AND INTERPRETATIONS OF ERTS DATA WITHIN THE SUSQUEHANNA RIVER BASIN Final Report, 1 Jun. 1972 - 30 Apr. 1975

G. J. McMurtry and G. W. Petersen, Principal Investigators Dec. 1975 182 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (Contract NAS5-23133)

(E76-10456; NASA-CR-148587; ORSER-SSEL-TR-21-75) Avail: NTIS HC $7.50 CSCL 08F

The author has identified the following significant results. The full potential of high quality data is achieved only with the application of efficient and effective interpretation techniques. An excellent operating system for handling, processing, and interpreting ERTS-1 and other MSS data was achieved. Programs for processing digital data are implemented on a large nondedicated general purpose computer. Significant results were attained in mapping land use, agricultural croplands, forest resources, and vegetative cover. Categories of land use classified and mapped depend upon the geographic location, the detail required, and the types of lands use of interest. Physiographic and structural provinces are spectacularly displayed on ERTS-1 MSS image mosaics. Geologic bedrock structures show up well and formation contacts can sometimes be traced for hundreds of kilometers. Large circular structures and regional features, previously obscured by the detail of higher resolution data, can be seen. Environmental monitoring was performed in three areas: coal strip mining, coal refuse problems, and damage to vegetation caused by insects and pollution.

N76-30625*# National Marine Fisheries Service, Bay Saint Louis, Miss.

THE FEASIBILITY OF UTILIZING REMOTELY SENSED DATA TO ASSESS AND MONITOR OCEANIC GAMEFISH

Kenneth J. Savastano, Principal Investigator and Thomas D. Leming 23 May 1975 48 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP

(NASA Order T-8217-B)

(E76-10457; NASA-CR-148588) Avail: NTIS HC $4.00 CSCL 08A

There are no author-identified significant results in this report.

N76-30626*# Alaska Univ., Fairbanks. Cooperative Wildlife Research Unit.

USE OF LANDSAT IMAGERY FOR WILDLIFE HABITAT MAPPING IN NORTHEAST AND EASTCENTRAL ALASKA Progress Report

A. J. LaPerriere, Principal Investigator 20 Aug. 1976 31 p refs ERTS

(Contract NAS5-20915)

(E76-10458; NASA-CR-148589; PR-4) Avail: NTIS HC $4.00 CSCL 06C

The author has identified the following significant results. Indications are that Alaskan scenes dated later than about September 5th are unsuitable for vegetational analyses. Such fall data exhibit a limited dynamic range relative to summer scenes and the informational content of the data is reduced such that discrimination between many vegetation types is no longer possible.

N76-30627*# Geological Survey, Reston, Va.

EVALUATION OF LANDSAT-1 IMAGE APPLICATIONS TO GEOLOGIC MAPPING, STRUCTURAL ANALYSIS AND MINERAL RESOURCE INVENTORY OF SOUTH AMERICA WITH SPECIAL EMPHASIS ON THE ANDES MOUNTAIN REGION Final Report, Jan. 1973 - Jul. 1974

William D. Carter, Principal Investigator Jun. 1976 114 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(NASA Order S-70243-AG)
(E76-10459; NASA-CR-148590) Avail: NTIS HC $5.50 CSCL 02B

The author has identified the following significant results. The discovery of copper mineralization along a lineament mapped in Area 7 (La Paz) has lent credence to the use of LANDSAT 1 data as a basic step in mineral exploration. In Area 9 (Copiapo Region), a number of lineaments were found to be associated with the largest copper deposits of the region. In Area 12 (Magallanes), the identification of what is believed to be a tertiary basin from LANDSAT 1 data has resulted in a new area for petroleum exploration. Band 7 images, as black and white transparencies, were found to be the most useful for geologic interpretation in both tropical vegetated areas and desert regions. Color composites made by the diazochrome process, chromaline process, and from color additive viewers provided additional information. Mosaics of LANDSAT 1 data covering 4 x 6 degrees of latitude and longitude compiled at the 1:1,000,000 scale were found to be an ideal size and format for most users.

N76-30628*# Geological Survey, Reston, Va.
EVALUATION OF LANDSAT-2 (ERTS) IMAGES APPLIED TO GEOLOGIC STRUCTURES AND MINERAL RESOURCES OF SOUTH AMERICA Progress Report, 30 Jun. 1975 - 30 Jun. 1976
William D. Carter, Principal Investigator and William S. Kowalik 1 Jul. 1976 23 p refs Sponsored by NASA ERTS
(E76-10460; NASA-CR-148591) Avail: NTIS HC $3.50 CSCL 08G

The author has identified the following significant results. The Salar of Coposa is located in northern Chile along the frontier with Bolivia. The surface was divided into six general classes of materials. Analysis of LANDSAT image 1243-14001 by use of interactive multispectral computer (Image 100) enabled accurate repetition of these general classes based on reflectance. The Salar of Uyuni is the largest of the South American evaporite deposits. Using image 1243-13595, and parallel piped computer classification of reflectance units, the Salar was divided into nine classes ranging from deep to shallow water, water over salt, salt saturated with water, and several classes of dry salt.

N76-30629*# California Univ., Berkeley. Space Sciences Lab.
AN INVENTORY OF IRRIGATED LANDS FOR SELECTED COUNTIES WITHIN THE STATE OF CALIFORNIA BASED ON LANDSAT AND SUPPORTING AIRCRAFT DATA Quarterly Progress Report, 25 Apr. - 25 Jul. 1976
Robert N. Colwell, Principal Investigator, Sharon Wall, and Dennis Noren 25 Jul. 1976 14 p refs ERTS
(Contract NAS5-20969)
(E76-10461; NASA-CR-148592; SSL-Ser-17-Issue-61) Avail: NTIS HC $3.50 CSCL 08B

There are no author-identified significant results in this report.

N76-30630*# Corps of Engineers, Waltham, Mass.
THE USE OF LANDSAT DCS AND IMAGERY IN RESERVOIR MANAGEMENT AND OPERATION Progress Report, period ending 1 Jun. 1976
Saul Cooper, Principal Investigator 1 Jun. 1976 6 p Sponsored by NASA
(E76-10462; NASA-CR-148593; PR-5) Avail: NTIS HC $3.50 CSCL 05B

The author has identified the following significant results. A tally of DCP messages received shows that the number of messages increased markedly at the beginning of the year as the downlink went into operation, but dropped off in May due to computer troubles.

N76-30631*# California Univ., Berkeley. Space Sciences Lab.
APPLICATION OF PHOTOINTERPRETATIVE TECHNIQUES TO WHEAT IDENTIFICATION. SIGNATURE EXTENSION AND SAMPLING STRATEGY Final Report, 15 May 1975 - 14 May 1976
Robert N. Colwell, Principal Investigator, Claire M. Hay, and Randall W. Thomas 14 May 1976 358 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-14565)
(E76-10463; NASA-CR-147833; SSL-Ser-17-Issue-33) Avail: NTIS HC $10.50 CSCL 08G

The author has identified the following significant results. Significant variance in actual wheat proportion is accounted for by quick-look, phase one estimates on full frame LANDSAT data from the previous crop year. An average correlation coefficient of approximately .8 can be expected between sample phase one and phase two wheat proportion data in the Kansas environment types examined. An average correlation coefficient between phase one cultivated land estimates and phase two wheat proportion estimates can be expected to be in the range of .7 to .9 in the Kansas environments. No statistically significant difference from zero was obtained for the average difference between regression wheat proportion estimates and corresponding USDA-based estimates for the 14 counties within the Kansas southwest CRD.

N76-30632*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HYDROGRAPHY SYNTHESIS USING LANDSAT REMOTE SENSING AND THE SCS MODELS
Robert M. Ragan and Thomas J. Jackson (Kentucky Univ., Lexington) Jul. 1976 63 p refs
(NASA-TM-X-71175; X-913-76-161) Avail: NTIS HC $4.50 CSCL 08H

The land cover requirements of the Soil Conservation Service (SCS) Model used for hydrograph synthesis in urban areas were modified to be LANDSAT compatible. The Curve Numbers obtained with these alternate land cover categories compare well with those obtained in published example problems using the conventional categories. Emergency spillway hydrographs and synthetic flood frequency flows computed for a 21.1 sq. mi. test area showed excellent agreement between the conventional aerial photo-based and the Landsat-based SCS approaches.
Author

N76-30633*# Nebraska Univ., Lincoln. School of Life Sciences.
APPLICATION OF REMOTE SENSING IN THE DETERMINATION OF WATER QUALITY IN NEBRASKA RESERVOIRS
Gary L. Hergenrader 22 Jul. 1976 11 p Sponsored by NASA
(NASA-CR-148776) Avail: NTIS HC $3.50 CSCL 08H

In June, July, and August, 1975, ground truth was collected from Lake McConaughy, a 35,000 acre reservoir in western Nebraska, coincident with the overflights of LANDSAT. Water samples were collected on six different dates and analyzed for turbidity, suspended solids, and chlorophyll, parameters which had correlated well with CCT reflectances. The correlations and regressions reported were derived from data obtained on only three of the six sampling dates. The radiance values from each of the four spectral bands were printed out in the form of a map of Lake McConaughy. Reflectances in the various bands were then obtained from the map at the appropriate sampling sites. The dependent variables chlorophyll, suspended solids, and turbidity were compared to the independent variables - reflectances in the four bands - by regression analysis. Both multiple and univariate regressions were examined. It is concluded that CCT's from LANDSAT can be used to detect and quantify the water quality parameters suspended solids, turbidity, and chlorphyll.
Author

N76-30634*# Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
APPLICATION OF REMOTE SENSING IN ESTIMATING EVAPOTRANSPIRATION IN THE PLATTE RIVER BASIN Final Report, 1 May 1972 - 30 Apr. 1976
Blaine L. Blad and Norman J. Rosenberg 30 Apr. 1976 36 p refs
(Grant NGL-28-004-020)
(NASA-CR-148775) Avail: NTIS HC $4.00 CSCL 08H

A 'resistance model' and a mass transport model for estimating evapotranspiration (ET) were tested on large fields of naturally subirrigated alfalfa. Both models make use of crop canopy temperature data. Temperature data were obtained with an IR

thermometer and with leaf thermocouples. A Bowen ratio-energy balance (BREB) model, adjusted to account for underestimation of ET during periods of strong sensible heat advection, was used as the standard against which the resistance and mass transport models were compared. Daily estimates by the resistance model were within 10% of estimates made by the BREB model. Daily estimates by the mass transport model did not agree quite as well. Performance was good on clear and cloudy days and also during periods of non-advection and strong advection of sensible heat. The performance of the mass transport and resistance models was less satisfactory for estimation of fluxes of latent heat for short term periods. Both models tended to overestimate at low LE fluxes. Author

N76-30635*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
MATRIX OF EDUCATIONAL AND TRAINING MATERIALS IN REMOTE SENSING
John C. Lindenlaub and Bruce M. Lube 1976 46 p
(Contract NAS9-14016)
(NASA-CR-147838; LARS-IN-052576) Avail: NTIS HC $4.00 CSCL 05B

Remote sensing educational and training materials developed by LARS have been organized in a matrix format. Each row in the matrix represents a subject area in remote sensing and the columns represent different types of instructional materials. This format has proved to be useful for displaying in a concise manner the subject matter content, prerequisite requirements and technical depth of each instructional module in the matrix. A general description of the matrix is followed by three examples designed to illustrate how the matrix can be used to synthesize training programs tailored to meet the needs of individual students. A detailed description of each of the modules in the matrix is contained in a catalog section. Author

N76-30636*# Itek Corp., Lexington, Mass. Optical Systems Div.
REQUIREMENTS AND CONCEPT DESIGN FOR LARGE EARTH SURVEY TELESCOPE FOR SEOS Final Report, Apr. 1974 - Apr. 1975
Paul Mailhot and John Bisbee Apr. 1975 219 p refs
(Contract NAS5-20074)
(NASA-CR-144796; Itek-75-9510-1) Avail: NTIS HC $7.75 CSCL 20F

The efforts of a one year program of Requirements Analysis and Conceptual Design for the Large Earth Survey Telescope for the Synchronous Earth Observatory Satellite is summarized. A 1.4 meter aperture Cassegrain telescope with 0.6 deg field of view is shown to do an excellent job in satisfying the observational requirements for a wide range of earth resources and meteorological applications. The telescope provides imagery or thermal mapping in ten spectral bands at one time in a field sharing grouping of linear detector arrays. Pushbroom scanning is accomplished by spacecraft slew. Author

N76-30637*# Bittinger (M. W.) and Associates, Inc., Fort Collins, Colo.
SOIL-MOISTURE GROUND TRUTH, HAND COUNTY, SOUTH DAKOTA Mission Report, 22 Jun. 1976
E. Bruce Jones Jul. 1976 24 p refs
(Contract NAS5-22312)
(NASA-CR-144805) Avail: NTIS HC $3.50 CSCL 08M

Soil samples were taken in the field and carefully preserved in taped metal containers for later laboratory gravimetric analysis to determine soil-moisture content. The typical sampling pattern used in this mission is illustrated, and the soil types encountered on the soil-moisture lines are summarized. The actual soil-moisture data were tabulated by range, township and section. Soil-moisture data obtained in fields of winter wheat and spring wheat are briefly summarized. Author

N76-30638*# Hughes Aircraft Co., Fullerton, Calif.
ADVANCED APPLICATION FLIGHT EXPERIMENT BREADBOARD PULSE COMPRESSION RADAR ALTIMETER PROGRAM Final Report, Jul. 1974 - Dec. 1975
Aug. 1976 147 p refs
(Contract NAS6-2558)
(NASA-CR-141411; FR-76-14-183) Avail: NTIS HC $6.00 CSCL 17I

Design, development and performance of the pulse compression radar altimeter is described. The high resolution breadboard system is designed to operate from an aircraft at 10 Kft above the ocean and to accurately measure altitude, sea wave height and sea reflectivity. The minicomputer controlled Ku band system provides six basic variables and an extensive digital recording capability for experimentation purposes. Signal bandwidths of 360 MHz are obtained using a reflective array compression line. Stretch processing is used to achieve 1000:1 pulse compression. The system range command LSB is 0.62 ns or 9.25 cm. A second order altitude tracker, aided by accelerometer inputs is implemented in the system software. During flight tests the system demonstrated an altitude resolution capability of 2.1 cm and sea wave height estimation accuracy of 10%. The altitude measurement performance exceeds that of the Skylab and GEOS-C predecessors by approximately an order of magnitude. Author

N76-30639# Institute for Water Resources, Fort Belvoir, Va.
ECONOMIC CONCEPTS AND TECHNIQUES PERTAINING TO WATER SUPPLY, WATER ALLOCATION AND WATER QUALITY Final Report
Eric D. Bovet Dec. 1975 293 p
(Contract DACW-76-M-0435)
(AD-A018242; IWR-Paper-75-P5) Avail: NTIS CSCL 13/2

The report presents in a systematic manner economic concepts and techniques helpful in analyzing alternative solutions to problems commonly found in planning for water supply and water quality. Seven economic studies published by the US Army Engineer Institute for Water Resources between 1971 and 1974, and related reports, were selected as source material for the reference manual. These do not cover in detail all facets of water supply, water allocation and water quality. The contents of the IWR sponsored studies fall under three main headings: Water Supply, Water Allocation and Water Quality. Waste Water Renovation for Reuse, which provides an alternative source of supply, was treated under water quality because of the problems raised by varying user tolerance to water of varying degrees of purity. GRA

N76-30640# Federal Energy Administration, Washington, D.C. Office of Coal and Electric Power Analysis.
US COAL RESOURCES AND RESERVES
N. A. Parker and B. C. Thompson May 1976 16 p refs
(PB-252752/1; FEA/B-76/210) Avail: NTIS HC $3.50 CSCL 08G

This report is made up of three sections: The first defines the different categories of coal resources and provides estimates of the extent of each. The second discusses the sulfur content of coal in relation to environmental standards, and the third presents data on coal reserves on Federal and Indian lands, where a major portion of the Nation's reserves are located. GRA

N76-30641# Missouri Univ., Kansas City.
MEASUREMENTS OF SPECTRAL REFLECTANCE AND OPTICAL CONSTANTS OF SELECTED ROCK SAMPLES FOR APPLICATION TO REMOTE SENSING OF SOIL MOISTURE
Wayne E. Holland, Marvin R. Querry, and Raymond M. Coveney 15 Jul. 1975 79 p refs
(Grant NOAA-04-4-158-27)
(PB-252468/4; NOAA-76022603) Avail: NTIS HC $5.00 CSCL 08H

The feasibility of using infrared satellite sensors to make quantitative measurements of soil moisture was investigated. The primary goal of the program was to compute the necessary basic parameters, including the reflectance and optical constants of rocks, which are constituents of all soils. Specific objectives of the program were: (1) to measure the infrared specular reflectance or ten of more bulk, natural minerals and rocks selected from the silicates, feldspars, carbonates, sulfates, oxides and hydroxides, and (2) to compute the real and imaginary parts of the complex refractive index of the samples by applying the Kramers-Kronig techniques to the spectra. The parameters determined would provide the basis for applying both the thermal and optical approaches to the interpretation of the infrared imagery. The infrared reflectance and optical constants of 11 minerals are given. Initial computations were made of the contrast

values for daytime and nighttime remote-sensing of water against a limestone background. GRA

N76-30642# Bureau of Mines, Twin Cities, Minn. Twin Cities Mining Research Center.
ELECTROTHERMAL FRACTURE OF COPPER SHALE
Carl F. Wingquist and Robert A. Lund Feb. 1976 21 p refs
(PB-251990/8; BM-RI-8106) Avail: NTIS HC $3.50 CSCL 08I

The Bureau of Mines investigated electrical resistance heating to effect thermal fragmentation of semiconductive rock. Tests carried out on copper bearing ores of the Nonesuch Shale Formation in the laboratory and in the field at White Pine, Mich., are described. Fieldwork included primary and secondary breakage tests. Heating tests on in situ rock failed to produce thermal damage to an extent considered useful; however, boulders up to 30 cu ft were effectively broken by the method. Power input to the test rock was taken from a 50-kV, 5-amp, dc power supply. GRA

N76-30643# Utah Water Research Lab., Logan.
WATER AS A FACTOR IN ENERGY RESOURCES DEVELOPMENT
A. Bruce Bishop, Melvin D. Chambers, and William O. Mace Jun. 1975 114 p refs
(Contract DI-14-31-0001-5045; OWRT Proj. A-028-UTAH(1))
(PB-250750/7; PRJER028-1; W76-05250) Avail: NTIS HC $5.50 CSCL 13B

Particularly where water supplies are short and water quality degradation is a critical consideration, the water resource system conflicts associated with energy development at alternative sites need to be carefully examined. To demonstrate the model structure and capabilities, an application is made to the energy resources region within the Utah portion of the Colorado River Basin. Surface water resources available by stream reaches are designated, and the possible energy developments requiring water inputs, for both extraction and conversion processes, are located. For the initial application of the model, optimal solutions were obtained for both energy maximization and water minimization which illustrate composite system effects and potential conflicts that could arise from various combinations of water allocation to energy resources developments. GRA

N76-30644# Geological Survey, Reston, Va. Office of International Geology.
APPLICATIONS OF ERTS PRODUCTS IN RANGE AND WATER MANAGEMENT PROBLEMS, SAHELIAN ZONE, MALI, UPPER VOLTA, AND NIGER Technical Report, Apr. - May 1974
M. E. Cooley and R. M. Turner 1975 96 p refs
(Grant PASA-TA(IC)-02-74)
(PB-251731/6; IR-WA-4) Avail: NTIS HC $5.00 CSCL 13B

The results are described of a brief field investigation to evaluate application of ERTS imagery to range and water management problems in Mali, Upper Volta, and Niger. It is concluded that the imagery can provide general overviews of regions or even countries and may be used in areas where few or no good ground surveys exist; can provide a basis for repetitive inventorying and monitoring transient environmental changes on the earth's surface; and can aid in solving special problems of disease sector control or human activity. Specific applications of the ERTS imagery were identified in river-blindness control; tse-tse fly control; bush-burning evaluation; distinction of arable from nonarable lands; analysis of problems of accelerated erosion; the annual flood of the Niger River; and ground-water development in fractures. GRA

N76-30645# Minnesota Univ., Minneapolis. Water Resources Research Center.
ENVIRONMENTAL ASSESSMENT AND DESIGN: PROCEEDINGS OF A SEMINAR
Beatrice F. Willard, Robert F. Post, Winston Borden, John Mohr, and George Hite Jan. 1975 60 p Presented at Environmental Assessment and Design Seminar, Arden Hills, Minn., 25-26 Nov. 1974
(PB-251909/8; WRRC-Bull-78; W76-06555;
OWRT-A-999-MINN(34)) Avail: NTIS HC $4.50 CSCL 13B

The purpose of this publication is to provide information on Federal and State (Minnesota) environmental impact statement requirements. Topics discussed include the intent of the environmental impact legislation, projects which require impact statements, and information which should be included in environmental impact statements. Case studies detailing positive and negative aspects of the environmental impact statement process are presented. Author (GRA)

N76-30646# Central Intelligence Agency, Washington, D.C. Office of Geographic and Cartographic Research.
CARTOGRAPHIC AUTOMATIC MAPPING (CAM), PROGRAM DOCUMENTATION. VERSION 4: USER'S GUIDE
P. Frederick Stepler and Warren Schmidt Mar. 1975 119 p
(PB-251390/1; OGCR-CD-75-1) Avail: NTIS HC $5.50 CSCL 08B

An IBM Systems 360 FORTRAN program that performs a wide variety of cartographic plotting tasks is described. It will connect points with straight lines or great circles and draw line grids, range rings, ellipses, cones, azimuths, and a host of other map features. The structure of CAM is modular to permit the easy addition of new features or subroutines to read data in a different format. New features included in Version 4 of CAM are the Polyconic projection, UTM grids and ticks, longitude and latitude ticks, legend box blockout, a route and corridor option, and twelve new line symbols. The sample plot instructions have been combined with the projection descriptions, which have been rewritten to be understandable to the noncartographer. GRA

N76-30647# Synectics Corp., Rome, N.Y.
GRAPHIC LINE FINISHING EXPERIMENTS Final Technical Report, Apr. 1974 - Dec. 1975
Thaddeus Kolassa Feb. 1976 173 p refs
(Contract F30602-74-C-0261; AF Proj 3201)
(AD-A022090; RADC-TR-76-47; Rept-636-C-2) Avail: NTIS CSCL 08/2

This report describes the evaluation of certain Advanced Cartographic System components under development at the RADC Experimental Cartographic Facility as a cartographic production system. The components evaluated included the Cartographic Conversion Station/PDP-7, the Cartographic Digitizer/Plotter/PDP-9 and the Automatic Color Scanning Device. Procedures for processing cartographic data from original input via digitization through editing and symbolization to final output were also evaluated. Significant aspects of various stages of the automated cartographic production process are commented on in detail. Conclusions reached as a result of this evaluation effort are set forth and recommendations made for future hardware/software/procedure improvements. Author (GRA)

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N76-30648 Ohio State Univ., Columbus.
THE SEMICONDUCTOR-ELECTROLYTE SYSTEM FOR SOLAR ENERGY CONVERSION Ph.D. Thesis
Young Gui Chai 1976 86 p
Avail: Univ. Microfilms Order No. 76-17971

The results of an investigation of semiconductor materials for use in the fabrication of solar cells are reported. CdS in 0.1 M CH3COOH showed good photovoltaic characteristics. The open circuit voltage was 1.2V and the maximum power conversion efficiency was 32% under 1 mW monochromatic light. GaAs in 0.1 M HCl also showed good photovoltaic characteristics. The open circuit voltage was 1.2 V, and the power conversion efficiency was 21% for 1 mW monochromatic radiation. However a large GaAs cell in 0.1 M HCl exhibited only 0.2% power conversion

efficiency under a solar simulator. CdSe in 0.1 M CH3COOH gave an open circuit voltage of 0.8 V and a moderate power conversion efficiency of 7.2%. CdTe-1 M NaOH displayed poor quality as a solar cell material. Short circuit quantum efficiency larger than unity was observed for CdS and CdSe. The use of polysulfide solution as the electrolyte was shown to successfully suppress anodic dissolution, the primary mechanism of charge transfer at the surfaces of these materials. Dissert. Abstr.

N76-30649# Committee on Commerce (U. S. Senate).
FUEL PROBLEMS OF THE NATION'S PUBLIC TRANSPORTATION SYSTEM RESULTING FROM THE CURRENT ENERGY SHORTAGE
Washington GPO 1974 207 p Hearings before Comm. on Commerce, 93d Congr., 2d Sess., 4-5 and 7 Mar. 1974
(GPO-48-894) Avail: Comm. on Commerce

Testimony regarding the adverse effects on the airline industry and the public of fuel shortages and fuel price escalation created by the Arab oil embargo is presented. The adequacy of fuel allocation regulations and the necessity of further legislative action in this area were considered. D.M.L.

N76-30650*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TRANSIENT ANALYSIS OF UNBALANCED SHORT CIRCUITS OF THE ERDA-NASA 100 kW WIND TURBINE ALTERNATOR
H. H. Hwang (Univ. of Hawaii) and Leonard J. Gilbert Jul. 1976 29 p refs
(NASA-TM-X-73459; E-8821) Avail: NTIS HC $4.00 CSCL 10B

Unbalanced short-circuit faults on the alternator of the ERDA-NASA Mod-0100-kW experimental wind turbine are studied. For each case, complete solutions for armature, field, and damper-circuit currents; short-circuit torque; and open-phase voltage are derived directly by a mathematical analysis. Formulated results are tabulated. For the Mod-O wind turbine alternator, numerical calculations are given, and results are presented by graphs. Comparisons for significant points among the more important cases are summarized. For these cases the transients are found to be potentially severe. The effect of the alternator neutral-to-ground impedance is evaluated. Author

N76-30651*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FUNDAMENTAL STUDIES OF BLACK CHROME FOR SOLAR COLLECTOR USE
G. McDonald, B. Buzek, and H. Curtis 1976 5 p ref Presented at Intern. Solar Energy Soc. Conf., Winnipeg, Canada, 15-20 Aug. 1976
(NASA-TM-X-73461; E-8824) Avail: NTIS HC $3.50 CSCL 10A

The thicknesses of black chrome plated for various times have been measured from electron photomicrographs and correlated with the solar spectrum absorptance and infrared emittance as calculated from spectral reflectance measurements. The maximum absorptance is reached at an average thickness of 0.5 micrometer. The emittance increases only slightly up to 1.0 micrometer but increases rapidly at thickness above 1.0 micrometer. Author

N76-30652*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MECHANICAL CAPACITOR Patent Application
Philip A. Studer and Harold E. Evans, inventors (to NASA) Filed 30 Jul. 1976 26 p
(NASA-Case-GSC-12030-1; US-Patent-Appl-SN-710035) Avail: NTIS HC $4.00 CSCL 10C

An energy storage device comprises a flywheel rotor in the form of a spokeless ring of filamentary, composite material rotating around a ring-shaped stator. Along the inner rim of the rotor, there is a layer of magnetically soft iron that forms homopolar, salient pole pairs. An ironless armature winding mounted on the stator extends into an air gap formed between the pole pairs. To bring the rotor up to speed, alternating current is supplied to the armature winding using electronic commutation. The armature current interacts with flux in the air gap to create a force acting to rotate the rotor. During coast down, current may be tapped from the rotor using commutation diodes. The rotor and stator are maintained in axial alignment to each other by magnetic flux produced by a permanent magnet in the stator. An electromagnet incorporated in the stator modulates permanent magnet flux to compensate for any eccentricity between the stator and the rotor. NASA

N76-30653*# AiResearch Mfg. Co., Los Angeles, Calif.
DEVELOPMENT OF A SOLAR-POWERED RESIDENTIAL AIR CONDITIONER: ECONOMIC ANALYSIS
28 Mar. 1975 16 p ref
(Contract NAS8-30758)
(NASA-CR-149976; AiResearch-74-10996(4)) Avail: NTIS HC $3.50 CSCL 10A

The results of investigations aimed at the development of cost models to be used in the economic assessment of Rankine-powered air conditioning systems for residential application are summarized. The rationale used in the development of the cost model was to: (1) collect cost data on complete systems and on the major equipment used in these systems; (2) reduce these data and establish relationships between cost and other engineering parameters such as weight, size, power level, etc; and (3) derive simple correlations from which cost-to-the-user can be calculated from performance requirements. The equipment considered in the survey included heat exchangers, fans, motors, and turbocompressors. This kind of hardware represents more than 2/3 of the total cost of conventional air conditioners. Author

N76-30654*# AiResearch Mfg. Co., Los Angeles, Calif.
DEVELOPMENT OF A SOLAR-POWERED RESIDENTIAL AIR CONDITIONER: DESIGN REQUIREMENTS AND TRADE-OFF PARAMETERS
22 Nov. 1974 12 p refs
(Contract NAS8-30758)
(NASA-CR-149971; AiResearch-74-10996(2)) Avail: NTIS HC $3.50 CSCL 10A

Data basic to the design, characterization, comparison, and evaluation of solar-powered residential air conditioner concepts are presented. Author

N76-30655*# AiResearch Mfg. Co., Los Angeles, Calif.
DEVELOPMENT OF A SOLAR-POWERED RESIDENTIAL AIR CONDITIONER. PROGRAM REVIEW
8 Apr. 1975 65 p refs
(Contract NAS8-30758)
(NASA-CR-149973; AiResearch-74-10996(5)) Avail: NTIS HC $4.50 CSCL 10A

Progress in the effort to develop a residential solar-powered air conditioning system is reported. The topics covered include the objectives, scope and status of the program. The results of state-of-art, design, and economic studies and component and system data are also presented. Author

N76-30656*# AiResearch Mfg. Co., Los Angeles, Calif.
DEVELOPMENT OF A SOLAR-POWERED RESIDENTIAL AIR CONDITIONER
13 Jan. 1975 36 p refs
(Contract NAS8-30758)
(NASA-CR-149972; AiResearch-74-10996(3)) Avail: NTIS HC $4.00 CSCL 10A

An extensive review of the literature was conducted which was concerned with the characterization of systems and equipment that could be applicable to the development of solar-powered air conditioners based on the Rankine cycle approach, and the establishment of baseline data defining the performance, physical characteristics, and cost of systems using the LiBr/H2O absorption cycle. Author

N76-30657*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RESULTS FROM THE IMP-J VIOLET SOLAR CELL EXPERIMENT AND VIOLET CELL BALLOON FLIGHTS
Edward M. Gaddy Feb. 1976 11 p refs
(NASA-TM-X-71168; X-711-76-29) Avail: NTIS HC $3.50 CSCL 10A

The IMP-J violet solar cell experiment was flown in an orbit with mild thermal cycling and low hard particle radiation. The

results of the experiment show that violet cells degrade at about the same rate as conventional cells in such an orbit. Balloon flight measurements show that violet solar cells produce approximately 20% more power than conventional cells. Author

N76-30658# Committee on Government Operations (U. S. House).
CONSERVATION AND EFFICIENT USE OF ENERGY
Washington GPO 1974 137 p refs Rept. for Comm. on Govt. Operations, 93d Congr., 2d Sess., 18 Dec. 1974
(H-Rept-93-1635; Rept-26) Avail: US Capitol, House Document Room

The potential for energy conservation in the industrial, transportation, residential, and commercial sectors is discussed. The economics of energy supply and consumption are analyzed. Recommendations for the facilitation of energy conservation are presented, and various areas of energy research are discussed. Environmental factors are also considered. D.M.L.

N76-30659*# AiResearch Mfg. Co., Los Angeles, Calif.
DEVELOPMENT OF A SOLAR-POWERED RESIDENTIAL AIR CONDITIONER: SCREENING ANALYSIS
25 Jul. 1975 67 p refs
(Contract NAS8-30758)
(NASA-CR-149974; AiResearch-74-10996(7)) Avail: NTIS HC $4.50 CSCL 10A

Screening analysis aimed at the definition of an optimum configuration of a Rankine cycle solar-powered air conditioner designed for residential application were conducted. Initial studies revealed that system performance and cost were extremely sensitive to condensing temperature and to the type of condenser used in the system. Consequently, the screening analyses were concerned with the generation of parametric design data for different condenser approaches; i. e., (1) an ambient air condenser, (2) a humidified ambient air condenser (3) an evaporative condenser, and (4) a water condenser (with a cooling tower). All systems feature a high performance turbocompressor and a single refrigerant (R-11) for the power and refrigeration loops. Data were obtained by computerized methods developed to permit system characterization over a broad range of operating and design conditions. The criteria used for comparison of the candidate system approaches were (1) overall system COP (refrigeration effect/solar heat input), (2) auxiliary electric power for fans and pumps, and (3) system installed cost or cost to the user. Author

N76-30660*# AiResearch Mfg. Co., Los Angeles, Calif.
DEVELOPMENT OF A SOLAR-POWERED RESIDENTIAL AIR CONDITIONER: SYSTEM OPTIMIZATION PRELIMINARY SPECIFICATION
J. Rousseau and K. C. Hwang 7 Nov. 1975 134 p
(Contract NAS8-30758)
(NASA-CR-149975; AiResearch-74-10996(8)) Avail: NTIS HC $6.00 CSCL 10A

Investigations aimed at the optimization of a baseline Rankine cycle solar powered air conditioner and the development of a preliminary system specification were conducted. Efforts encompassed the following: (1) investigations of the use of recuperators/regenerators to enhance the performance of the baseline system, (2) development of an off-design computer program for system performance prediction, (3) optimization of the turbocompressor design to cover a broad range of conditions and permit operation at low heat source water temperatures, (4) generation of parametric data describing system performance (COP and capacity), (5) development and evaluation of candidate system augmentation concepts and selection of the optimum approach, (6) generation of auxiliary power requirement data, (7) development of a complete solar collector-thermal storage-air conditioner computer program, (8) evaluation of the baseline Rankine air conditioner over a five day period simulating the NASA solar house operation, and (9) evaluation of the air conditioner as a heat pump. Author

N76-30661# Atomic Energy of Canada Ltd., Pinawa (Manitoba).
NUCLEAR POWER FOR DISTRICT HEATING
R. B. Lyon and R. O. Sochaski Sep. 1975 70 p refs
(AECL-5117) Avail: ERDA Depository Libraries HC $4.50 Scientific Document Distribution Office, Atomic Energy of Canada Limited, Chalk River, Ontario HC $1.50

Current district heating trends are towards an increasing use of electricity. The evaluation of an alternative means of energy supply, the direct use of thermal energy from CANDU nuclear stations, is described. The energy would be transmitted via a hot fluid in a pipeline over distances of up to 40 km. Advantages of this approach include a high utilization of primary energy, with a consequent reduction in installed capacity, and load flattening due to inherent energy storage capacity and transport delays. Disadvantages include the low load factors for district heating, the high cost of the distribution systems and the necessity for large-scale operation for economic viability. This requirement for large-scale operation from the beginning could cause difficulty in the implementation of the first system. Various approaches have been analyzed and costed for a specific application -- the supply of energy to a district heating load centre in Toronto from the location of the Pickering reactor station about 40 km away. Author (NSA)

N76-30662# Atomic Energy of Canada Ltd., Pinawa (Manitoba).
SUPPLY OF STEAM FROM CANDU REACTORS FOR HEAVY WATER PRODUCTION
R. F. S. Robertson Sep. 1975 16 p refs Presented at the IAEA Conf. on Utilization of Heat from Nuclear Reactors for Industrial Processes and District Heating, Pinawa, Manitoba. 2-6 Sep. 1974. Presented to the 15th Annual Meeting of the Canadian Nuclear Assoc., 16 Jun. 1975
(AECL-5118; Conf-7409145-1) Avail: ERDA Depository Libraries HC $4.50 Scientific Document Distribution Office, Atomic Energy of Canada Limited, Chalk River, Ontario HC $0.50

The production of heavy water is an energy intensive process because very large amounts of water must be heated, cooled and pumped. By 1980, Canada's energy needs for D2O production will be 420 MW of electrical energy and 3,600 MW of thermal energy (as steam). The nature of the process demands that this energy supply be exceptionally stable. Production plants are located at or close to nuclear electricity generating sites where advantage can be taken of the low cost of both the electricity and steam produced by nuclear reactors. Reliability of energy supply is achieved by dividing the load between the multiple units which comprise the sites. The present and proposed means of energy supply to the production sites at the Bruce Heavy Water Plant in Ontario and the La Prade Heavy Water Plant in Quebec is described. Author (NSA)

N76-30663# Los Alamos Scientific Lab., N.Mex.
PERFORMANCE OF MULTIHUNDRED-WATT FUELED-SPHERE ASSEMBLIES IN THE SAFETY VERIFICATION TEST
E. M. Cramer Sep. 1975 25 p refs
(Contract W-7405-eng-36)
(LA-6082; UC-33) Avail: NTIS HC $5.00

Seven fueled-sphere assemblies equivalent to those proposed for use in multihundred-watt thermoelectric generators, were subjected to conditions that simulated the sequential environments produced by an orbital abort and earth impact. All assemblies met the specifications for flight quality units. Visual examination indicated that all the iridium shells had lost their containment capability; however, rupturing of two shells was not confirmed. Five were obviously ruptured, and the fuel in three was exposed. All iridium fractures were essentially intergranular. Half of the vent assemblies failed to pass helium at ambient temperature after the test. Failure was because of nonmetallic materials in the vent frits. Release of plutonia per unit area of cracks in a containment shell ruptured by simulated earth impact was determined. NSA

N76-30664# Max-Planck-Institut fuer Plasmaphysik, Garching (West Germany).
APPROACH TOWARD DETERMINING AND ASSESSING EFFECTS OF INNOVATIONS IN ENERGY SUPPLY BY MEANS OF A COMBINED ENERGY AND ECONOMY MODEL
R. Buende May 1975 79 p refs In GERMAN; ENGLISH summary
(IPP-4/132) Avail: ERDA Depository Libraries HC $5.00

The energy system is represented as part of a national economy and analyzed by means of the input - output technique. The development of a mathematical model based on two existing

models using the same technique is described. This will allow the time behavior of the energy system and the total system to be simulated and optimized for different objective functions and constraints. In addition, consequences of impacts on the system, e.g., the development of a new energy source such as the fusion reactor, can be shown. Author (ERA)

N76-30665# Institut Franco-Allemand de Recherches, St. Louis (France).
NEW RESULTS IN FERROELECTRIC ENERGY CONVERSION USING METASTABLE FERROELECTRIC CERAMICS [RESULTATS NOUVEAUX DANS LE DOMAINE DE LA CONVERSION D'ENERGIE FERROELECTRIQUES METASTABLES]
F. Bauer, Y. Fetiveau (Inst. Natl. des Sci. Appl., Villeurbanne, France), and L. Eyraud (Inst. Natl. des Sci. Appl., Villeurbanne, France) 28 Aug. 1974 13 p refs In FRENCH Presented at the meeting of the Deut. Phys. Ges. Comm. on Phys. des Phenomenes Ultra-rapides, Stuttgart, 4-9 Mar. 1974
(ISL-CO-20/74) Avail: NTIS HC $3.50

Ferroelectric ceramics (PbZrTiO3) with high Zr percentage are shown to be usable for mechano-electric energy conversion. Depending on their composition they can be ferro or antiferroelectric at room temperature. In the presence of a high electric field and under specified conditions, a polarization occurs and remains in a metastable ferroelectric state. Under adiabatic irreversible depolarization provoked by a plane shock wave the yield is high of the order 1.7 J/cu cm. ESA

N76-30666# Institut Franco-Allemand de Recherches, St. Louis (France).
FERROELECTRIC CERAMICS: APPLICATION TO MECHANICAL ELECTRICAL ENERGY CONVERSION UNDER SHOCK COMPRESSION
F. Bauer, K. Vollrath, Y. Fetiveau (Inst. Natl. des Sci. Appl., Villeurbanne, France), and L. Eyraud (Inst. Natl. des Sci. Appl., Villeurbanne, France) 1 Jul. 1975 14 p refs Presented at the IEEE Symp. on Appl. of Ferroelec., Albuquerque, N. Mex., 9-11 Jun. 1975
(ISL-CO-206/75) Avail: NTIS HC $3.50

The irreversible conversion of mechanical to electrical energy in ferroelectric ceramics of the Pb(Zr(1-x)Ti(x))O3 type with a considerable proportion of zirconium was studied. Depolarization of the ceramics was realized under a shock compression between 5 and 100 kbar. The electrical energy was measured with a resistance equal to that of the generator. The maximum electrical energy obtained at about 20 kbar, was of the order of 1.8 J/cu cm with a disk of Pb(Zr(0.965)Ti(0.035)) O3 + 1% Nb2O5. Energy conversion efficiency decreases when the shock intensity exceeds 25 kbar. Author (ESA)

N76-30667# Mitre Corp., McLean, Va.
GASIFICATION/COMBINED-CYCLE SYSTEM FOR ELECTRIC POWER GENERATION Final Report
J. Bruce Truett Mar. 1976 50 p refs
(Contract EPA-68-01-3118)
(PB-251823/1; EPA-600/2-76-085; MTR-7176) Avail: NTIS HC $4.00 CSCL 07A

A type of gasification/combined cycle system is reported that is being considered for construction that employs the synthesis gas generation process to produce a fuel gas by partial oxidation of a hydrocarbon feedstock. The gas is cleaned to remove sulfur compounds, ash, and particulates, then burned as fuel for the gas turbine in a combined cycle power system. The commercially proven process accepts a large variety of hydrocarbons as feedstocks. GRA

N76-30668# Aerospace Corp., Los Angeles, Calif.
ALASKAN NATURAL GAS TRANSPORTATION SYSTEMS ECONOMIC AND RISK ANALYSIS: FINAL CONCLUSIONS AND RESULTS Final Report, Dec. 1974 - Feb. 1976
Feb. 1976 559 p refs
(Contract DI-08550-B05-16)
(PB-250361/3; DOI/OMPD/AG-76/01) Avail: NTIS HC $16.25 CSCL 21D

Various transportation systems for natural gas on the North Slope of Alaska are studied including systems similar to those proposed by the Arctic Gas Study group and the El Paso Alaska Co. Subjects studied include the supply of natural gas from Prudhoe Bay and the Mackenzie Delta; supply and demand for natural gas in the lower 48 states; construction schedule, capital costs, and operating and maintenance expenses for pipelines, liquefaction facilities, and cryogenic carriers; feasibility of large displacement plans; risks of cost overruns, schedule delays, and flow interruption; balance of payments impacts; and average cost of service. From the data, a cost-benefit analysis was conducted which measured the net economic benefits of each system to the Nation. GRA

N76-30669# Development Sciences, Inc., East Sandwich, Mass.
A STUDY TO DEVELOP ENERGY ESTIMATES OF MERIT FOR SELECTED FUEL TECHNOLOGIES Final Report
Alton J. Frabetti, Charles N. Flinkstrom, Morton Gorden, Russel A. Lovell, Jr., Charles Sheldon, II, James D. Westfield, and Peter F. Way 23 Sep. 1975 385 p refs
(Contract DI-14-01-0001-2141)
(PB-249994/5; DSI-038) Avail: NTIS HC $10.75 CSCL 10A

This study calculates the true energy costs to society associated with the delivery of a given amount of usable energy (1000 Btu) by various energy supply systems. Included as part of the energy costs were the direct process energy requirements and also the indirect costs associated with the production of the plant operating supplies and (amortized) capital equipment. GRA

N76-30670# Electric Power Research Inst., Palo Alto, Calif.
NUCLEAR POWER, COAL, AND ENERGY CONSERVATION Special Report No. 34
P. L. Auer, A. S. Manne, and O. S. Yu Mar. 1976 35 p refs
(PB-251262/2; EPRI-SR-34) Avail: NTIS HC $4.00 CSCL 10A

A programming model is used to explore options by which the U.S. may realistically move from its dependence on oil and gas to a more diversified energy economy based on nuclear power and/or coal. Supply options considered are: direct combustion of coal; conversion of coal to synthetic fuels; petroleum, natural gas, and oil shale resources; nuclear energy from light water and fast breeder reactors; hydrogen via electrolysis; solar power; and fusion. GRA

N76-30671# Federal Power Commission, Washington, D.C. Bureau of Natural Gas.
THE GAS SUPPLIES OF INTERSTATE NATURAL GAS PIPELINE COMPANIES - 1974
Mar. 1976 126 p
(PB-251256/4) Avail: NTIS HC $6.00 CSCL 21D

Contents: Total interstate gas supply; summary, domestic gas supply trends interstate pipeline companies; imports and exports, regional distribution of domestic gas reserves by FPC gas areas and by state; domestic gas reserves, major gas supply companies; total gas supply composition by company; deliverability. GRA

N76-30672# Giner, Inc., Waltham, Mass.
EVALUATION OF THE FEASIBILITY OF LOW-COST CARBON DIOXIDE REMOVAL/TRANSFER METHODS FOR FUEL CELL APPLICATION Final Report
Jose Giner and Larry Swette Nov. 1975 222 p refs
(PB-251263/0; EPRI-391) Avail: NTIS HC $7.75 CSCL 10B

The feasibility of removing carbon dioxide from hydrogen for two specific fuel cell system applications was investigated. In the first application, CO2 is to be removed from H2/CO2 mixture to produce pure hydrogen that can be used in an alkaline electrolyte fuel cell. In the second application CO2 has to be added to the air entering the fuel cell cathode. Topics discussed include general considerations regarding hydrogen and carbon dioxide separation; specific separation methods; analysis of the alkaline fuel cell system; the molten carbonate system; experiments on hydrogen purification by electrolytic transfer; and experiments aimed at determining whether partially hydrophobic carbon particles would provide more efficient packing for CO2 absorption towers than conventional packing. GRA

N76-30673# National Bureau of Standards, Washington, D.C. Office of Energy Conservation.
ENERGY CONSERVATION PROGRAM GUIDE FOR IN-

DUSTRY AND COMMERCE (EPIC). SUPPLEMENT 1 Final Report
Robert G. Massey, ed. Dec. 1975 95 p Sponsored in part by FEA, Washington, D. C., Office of Energy Conservation and Environment
(PB-250855/4; NBS-HB-115-Suppl-1; LC-74-600153) Avail: NTIS HC $5.00 CSCL 10A

The Energy Conservation Program Guide for Industry and Commerce is a handbook to assist business firms to establish an on-going conservation program. This supplement contains simplified management program, additional conservation opportunities, case studies, and sources of information. GRA

N76-30674# Philips Labs., Briarcliff Manor, New York.
STUDY OF SAFETY ASPECTS OF HIGH-TEMPERATURE THERMAL-ENERGY STORAGE SYSTEMS Interim Technical Report, Jul. - Dec. 1975
O. Boser Jan. 1976 14 p
(Grant NSF AER-75-20605)
(PB-252336/3; PL-2-TE-76-0108; NSF/RA-760023) Avail: NTIS HC $3.50 CSCL 07D

Safety aspects were studied for storing thermal energy at high temperatures (750C) using a eutectic mixture of fluorides of various alkaline and alkaline earth metals. A two faceted approach was chosen: (1) a theoretical and experimental investigation of the corrosion of the container material and of possible reactions of the fluorides with the environment and with the insulation material around the container; (2) an experimental investigation of the behavior of the liquid fluorides in the event of rupture of the container. Various test specimens (fluoride mixture/container/insulation) will be ruptured and observed with high-speed photography. GRA

N76-30675# Utah State Univ., Logan.
THE MARKET CAPTURE POTENTIAL OF SINGLE VERSUS MULTI-STRUCTURE SOLAR ENERGY SPACE CONDITIONING SYSTEMS: 1975 - 2010
H. Craig Petersen Jan. 1976 87 p refs
(Grant NSF AER-74-09043-A01)
(PB-252451/0; NSF/RA-760024) Avail: NTIS HC $5.00 CSCL 13A

One of the main problems with solar energy space conditioning and water heating systems is that systems mounted on individual structures require a certain type of roof orientation and tilt, and are usually not economically-viable for retrofitting of existing structures. If solar energy systems could be ground-mounted and serve small groups of structures, then these constraints might be eliminated. This report considers the implications of ground-mounted, multi-structure systems. It considers the relative cost of single vs. multi-structure systems and how much the rate of solar energy use can be accelerated if multi-structure systems are made available. GRA

N76-30676# Allied Chemical Corp., Buffalo, N.Y. Specialty Chemicals Div.
DEVELOPMENT OF NEW WORKING FLUIDS OF SOLAR RANKINE HEAT PUMPS Final Report, 1 May 1974 - 1 May 1975
R. A. Allen and L. I. Stiel 1 May 1975 49 p refs
(Grant NSF GI-42506)
(PB-252515/2; NSF/RANN/SE/GI-42506/FR-75-2; NSF/RA/N-75-239) Avail: NTIS HC $4.00 CSCL 13A

The effect of the thermodynamic properties of working fluids on the performance of a solar powered heat pump was analyzed. Cycle and overall efficiencies were calculated for approximately 20 halocarbons and other substances. The fluids are classified by boiling points, and results are tabulated for operation both in cooling and heating modes. Plots are also presented indicating the variation of efficiencies with the maximum temperature, degree of regeneration, and condenser and evaporator temperatures. Of the fluids considered, R-11 R-113, R-133a, R-142, and toluene have the highest overall efficiencies for a single fluid system operating at an upper temperature of 180F. GRA

N76-30677# Virginia Univ., Charlottesville.
PROCEEDINGS OF THE WORKSHOP ON SOLAR ENERGY STORAGE SUBSYSTEMS FOR THE HEATING AND COOLING OF BUILDINGS
Lembit U. Lilleleht, J. Taylor Beard, and F. Anthony Iachetta 18 Apr. 1975 191 p refs Workshop held at Charlottesville, Va., 16-18 Apr. 1975 Sponsored by the Am. Soc. of Heating, Refrigerating and Air Conditioning Engineers, Inc., N. Y.
(Grant NSF AER-75-06713)
(PB-252449/4; NSF/RA/N-75-041) Avail: NTIS HC $7.50 CSCL 13A

The current status of the thermal energy storage field, particularly as it relates to energy storage subsystems in buildings is reviewed. Topics ranged from the sensible heat storage in water to latent heat storage in chemical bonds; from use of hot water tanks to building heat capacity to long term storage in ice houses and aquifers. GRA

N76-30678# RMC Research Corp., Bethesda, Md.
INTERCITY PASSENGER TRANSPORTATION: MODE/ENERGY CONSERVATION. VOLUME 1: EXECUTIVE SUMMARY Final Report
George Roche and Armando M. Lago Dec. 1975 32 p refs Sponsored in part by FEA
(Contract EQ4AC028)
(PB-250883/6; RMC-UR-286-Vol-1; EQ5174130281-Vol-1) Avail: NTIS HC $4.00 CSCL 10A

The energy conservation potential for 1980 and 1985 of alternative intercity passenger transportation policies for the United States is summarized. A national intercity passenger transportation model was developed and used to simulate alternative energy conservation policies. The model predicts household trip rates by mode and purpose of travel for five income groups, four distance markets, and three sizes of groups. GRA

N76-30679# Battelle Columbus Labs., Ohio.
ASSESSMENT OF DEGREE OF FLEXIBILITY IN FUEL DISTRIBUTION PATTERNS Final Report
E. H. Hall, A. A. Putnam, and R. L. Major Mar. 1976 80 p refs
(Contract EPA-68-02-1323)
(PB-251675/5; EPA-600/2-76-076) Avail: NTIS HC $5.00 CSCL 13B

The results are given of a study to evaluate the potential of fuel switching as an element of an overall strategy for the control of sulfur oxide emissions from stationary sources. Blocks of misplaced fuels (i.e., clean fuels now burned in large sources and dirty fuels now burned in small sources) were identified. Various potential constraints to switching the misplaced fuels were evaluated. These included: equipment constraints, business constraints, and fuel transportation constraints. From these evaluations, the quantities of misplaced fuels were identified which are not limited by any of the constraints, and therefore which can be considered suitable for switching. GRA

N76-30680# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLID ELECTROLYTES: ALKALI-ION TRANSPORT IN SKELETON STRUCTURES Semiannual Technical Summary No. 2, 1 Jul. - 31 Dec. 1975
J. B. Goodenough, H. Y-P. Hong, J. A. Kafalas, and K. Dwight 31 Dec. 1975 41 p refs
(Contract F19628-76-C-0002; ARPA Order 2696)
(AD-A022199; ESD-TR-76-29) Avail: NTIS CSCL 20/8

We have demonstrated the existence of fast, three-dimensional Na--ion transport in the system Na1-3yZR2(P1-YSIy04)3 for less than or equal to 1. At 300 C, the operating temperature of a Na-S battery, the resistivity(5 ohms-cm)for Na--ion transport in Na3Zr2PSi2012 is competitive with the best beta-alumina. The activation energy for Na--ion transport, about 0.26 eV, is about 0.08 eV higher than that of beta-alumina, which makes this compound superior to the best beta-alumina at temperatures greater than 300 C, inferior at lower temperatures. The compound is stable in molten sodium and can be sintered at 1250 C. We have elected to concentrate on the fabrication of ceramic cups suitable for cell construction in order to test the chemical stability of this compound under the operating conditions of a Na-S cell. Author (GRA)

N76-30681# Teknekron, Inc., Berkeley, Calif.
A TECHNICAL AND ECONOMIC STUDY OF WASTE OIL RECOVERY. PART 4: ENERGY CONSUMPTION IN WASTE OIL RECOVERY. PART 5: A FIELD TEST OF THE QUALITY

OF RE-REFINED LUBE OILS. PART 6: A REVIEW OF RE-REFINING ECONOMICS Final Report
Peter M. Cukor and Timothy Hall Oct. 1975 141 p refs
(Contract EPA-68-01-2904)
(PB-251716/7; EPA-530/SW-90c.4-Pt-4;
EPA-530/SW-90c.4-Pt-5; EPA-530/SW-90c.4-Pt-6) Avail: NTIS HC $6.00 CSCL 11H

This report contains the following studies: An energy balance of waste oil recycling as lube oil and waste oil recovery as fuel oil; a description of a potential field test re-refined lube oil using motor vehicles on a federal facility; and an update of re-refining economies reflecting increased prices of petroleum products (1974-75). GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N76-30682 Washington Univ., Seattle.
THE NATURE OF AEROSOL PARTICLES FROM A PAPER MILL AND THEIR EFFECTS ON CLOUDS AND PRECIPITATION Ph.D. Thesis
Edward Evans Hindman, II 1975 260 p
Avail: Univ. Microfilms Order No. 76-17495

A series of airborne measurements was made to determine if the paper mill at Port Townsend, Washington, is a significant source of large and giant cloud condensation nuclei (CCN) and to determine if these CCN alter the droplet size distributions of clouds located downwind of the mill. The field data were used as inputs to theoretical cloud models to calculate the effects of the CCN on cloud droplet size distributions and on the amounts of rainfall from model cumulus and stratus clouds.Dissert. Abstr.

N76-30683 Washington Univ., Seattle.
ANALYSIS OF ATMOSPHERIC AEROSOLS BY HIGH RESOLUTION MASS SPECTROMETRY Ph.D. Thesis
Dagmar Rais Cronn 1975 245 p
Avail: Univ. Microfilms Order No. 76-17446

Computer controlled, high resolution mass spectrometry was used to identify ambient aerosols in the St. Louis and Los Angeles areas. Approximately 80 components were routinely identified in the samples including two groups of compounds not previously identified in ambient aerosols (probably oxidation products of toluene and alpha pinene). Specific components were categorized according to the diurnal patterns exhibited. Daily cycles of components which correlate with carbon monoxide and peak automotive traffic were shown to be primary automotive emissions. Materials which are formed secondarily in the atmosphere from primary precursors show a different diurnal cycle which correlates with ozone. Dissert. Abstr.

N76-30684 Washington Univ., Seattle.
A NEW APPROACH FOR MEASURING ATMOSPHERIC CONCENTRATIONS OF AMMONIA Ph.D. Thesis
Robert James Farber 1975 151 p
Avail: Univ. Microfilms Order No. 76-17462

A method for measuring trace quantities of gaseous ammonia directly from the atmosphere is described in which gas chromatography, a catalytic converter and an NO chemiluminescent analyzer are combined into one apparatus. A 25 cc sample of ambient air is injected into the gas chromatographic column. A solid columnar support is used to separate ammonia from other atmospheric gases. It was found that no detectable amount of ammonia was irreversibly adsorbed on the column. From here, the ammonia and pure O2 pass into a stainless steel tube. The tubing serves as a catalyst for the oxidation of ammonia to nitric oxide. At temperatures greater than 750 C, the oxidation of ammonia to nitric oxide is approximately 100% and remains 100% over a widely varied range of ammonia concentrations. From the catalytic converter the NO passes into a NO chemiluminescent detector and on to a recorder where chromatograms of ammonia peaks are obtained. Dissert. Abstr.

N76-30685*# Old Dominion Univ., Norfolk, Va.
DIFFERENTIAL ABSORPTION AND SCATTERING SENSITIVITY PREDICTIONS Topical Report, Jun. 1974 - Nov. 1975
Richard T. Thompson, Jr. Washington NASA Aug. 1976 43 p refs
(Grant NsG-1060)
(NASA-CR-2627; PGSTR-PH75-19) Avail: NTIS HC $4.00 CSCL 13B

A set of general equations for evaluating the sensitivity of the Differential Absorption and Scattering (DAS) technique based upon a conventional analysis of statistical errors is derived. The equations are put in a proper form for evaluating total column density and range resolved concentration measurements of a variety of atmospheric species. The derived equation are subsequently used to analyze the sensitivity of DAS in three specific applications assuming realistic parameters for the optical and electronic components of proposed DAS systems. The three DAS applications evaluated are: (1) measurement of nitrogen at ground levels over a horizontal path; (2) measurement of atmospheric ozone depletion in the wake of a jet engine at 20 km altitude; and (3) measurements of the ozone distribution in the atmosphere from an orbiting space platform, in a downward viewing mode. The results of this study have shown that with reasonable laser energy and telescope receiver dimensions, DAS is capable of meeting requirements for performing these measurements. Author

N76-30686# Oak Ridge National Lab., Tenn.
IMPACT OF POWER PLANTS ON AQUATIC SYSTEMS: A SOCIAL PERSPECTIVE
C. C. Coutant 1975 8 p ref Presented at workshop on Impact of Power Plants on Aquatic Systems, Pacific Grove, Calif., 28 Sep. 1975 Sponsored by ERDA
(CONF-750980-2) Avail: NTIS HC $3.50

Topics discussed are: aquatic effects of thermal electric power stations; legal aspects of water pollution; EPA provisions for levels of thermal discharges to assure protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in a body of water; cost benefit analysis of steam electric power effluents; cooling systems and siting of power plants; simulation modeling of population dynamics; and sociological aspects of water pollution. NSA

N76-30687# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Dept. de Protection.
CONSEQUENCES OF THE RELEASE OF CHEMICAL POLLUTANTS ON THE TRANSFERS OF RADIOACTIVE PRODUCTS IN AQUATIC SYSTEMS
R. Bittel 1975 3 p Presented at the Third European IRPA Congr., Amsterdam, 13 May 1975 Sponsored by ERDA
(CEA-CONF-3123; Conf-750518-4) Avail: NTIS Avail: ERDA Depository Libraries HC $3.50

With the increasing rate of industrial activities, aquatic systems undergo, more and more frequently, the accumulation of chemical and radioactive wastes released separately or associated in the same discharge. An attempt is made to evaluate the consequence of the association of pollutants. Emphasis is given to heavy metal pollution and complexing agents. Author (NSA)

N76-30688# Kiel Univ. (West Germany). Inst. fuer Meereskunde.
THE EFFECT OF SEWAGE ON PLANKTON IN THE KIEL BIGHT Final Report [UNTERSUCHUNGEN UEBER DEN EINFLUSS VON ABWASSER AUF DAS PLANKTON IN DER KIELER BUCHT]
Ulrich Horstmann, Sten Schiemann, Peter Martens, Eike Hansen, and Peter Weigel Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1975 43 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-M-75-08) Avail: NTIS HC $4.00; ZLDI, Munich DM 9.05

Activities from 1972 to 1974 of a plankton working group are reported. These concerned three basic problems: (1) The influence of sewage on the distribution of plankton and primary production of organic carbon. This comprises the work on the eutrophication of Flensburg Fiord, investigations on the ecology of blue-green algae and their distribution in relation to different nutrients, and measurements of the primary production of planktonic algae in the inner Kiel Fiord and the Baltic. (2) In-situ

experiments on the influence of different sewage-concentrations on natural plankton-populations in isolated water bodies. (3) Development of a method for the determination of heavy metals in plankton and determination of the actual content of heavy metals in the plankton of the Baltic. Author (ESA)

N76-30689# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Reaktionskinetik.

USE OF DIODE LASERS IN THE INFRARED SPECTRAL RANGE FOR DETERMINING POLLUTANT CONCENTRATIONS [BESTIMMUNG VON SCHADSTOFFKONZENTRATIONEN MIT HILFE VON DIODEN-LASERN IM INFRAROTEN SPEKTRALBEREICH]

S. Kelm Dec. 1975 30 p refs In GERMAN
(DLR-IB-453-75/1) Avail: NTIS HC $4.00

Concentrations of some air pollutants were determined using infrared diode laser spectroscopy. The function of the specially developed PbS(1-x)Se(x) diode laser is described and the measuring procedure is presented. The choice of the optimal infrared spectral range is discussed, and an estimation of the attainable lower concentration limit is given. It is shown that concentrations down to 1 ppm can be measured with this new technique which, compared to the corresponding visible light or ultraviolet technique, has the advantage that all contaminants, such as CO, NO, NO2, N2O, SO2, H2S, NH3, HCN, and O3 have absorption lines in the infrared. Moreover the equipment used is cheaper. The disturbance, in the infrared, of the H2O and CO2 absorption bands can be largely overcome by using short (10 cm) absorption paths. ESA

N76-30690# Argonne National Lab., Ill.

AIRPORT VICINITY AIR POLLUTION MODEL USE GUIDE Final Report

I. T. Wang, L. A. Conley, and D. M. Rote Dec. 1975 275 p refs
(Contract DOT-FA71WAI-223)
(AD-A020352; FAA-RD-75-230) Avail: NTIS CSCL 13/2

This report describes in detail the computer code of the Airport Vicinity Air Pollution (AVAP) model and the variables required to exercise the model. The AVAP model is a computerizing comprehensive airport simulation model which can serve as a tool in evaluating the total air quality impact of all airport operations on the airport vicinity. The report focuses on the operational procedures and descriptions of the structure and function of the computer code. The structure, chain of command that links the subroutines, and the more important computational subroutines are illustrated in detailed flow diagrams. The basic formulas used in the calculations are presented. One section provides guidelines for preparation of the input data and can serve as a 'mini' instruction manual by itself. Procedures are described by which the airport and environ data can be collected and cast into the proper forms. The data deck formating, variable limits and omissions permitted, and the computer configuration required to run the code are discussed. Samples of input and output are included. GRA

N76-30691# Texas A&M Research Foundation, College Station.

THE HYDRODYNAMICS OF POROUS BARRIER OIL RECOVERY SYSTEMS Final Report

D. J. Norton and J. L. Rand Jul. 1975 75 p refs
(Contract DOT-CG-42444-A)
(AD-A014501; USCG-D-146-75) Avail: NTIS CSCL 13/2

The porous barrier concept consists of a solid barrier with several upstream porous barriers. The porous barriers act to dissipate the energy of the flow through them and to divert flow under the solid barrier in a gradual manner. The use of the porous barriers allows operation of a solid barrier or boom in currents well above the critical speed for a single solid barrier. The success of the concept depends upon the number, type, and placement of the porous barriers. During the present investigation, some 20 porous materials were classified as to their drag properties. Velocity measurements were made between combinations of these barriers, and oil recovery tests were run. Data have been collected for free stream velocities from 0.8 to 5.0 fps. Both Diesel no. 2 and 140 wt. Lube oil were employed. Tests in a flume indicated that virtually all the oil could be contained up to 4.5 fps for Diesel no. 2. Above that speed losses were noted for the configurations tested. Testing in a flow channel facility for velocities up to 7 fps confirmed these observations with oil viscosities up to 580 centistokes. Author (GRA)

N76-30692# Harvard Univ., Cambridge, Mass.

ENVIRONMENTAL MODELS FOR PLANNING AND POLICY MAKING. VOLUME 2: THE COSTS OF GROWTH: REVENUE AND EXPENDITURE IMPLICATIONS OF SUBURBAN TOWN DEVELOPMENT

Peter M. Allaman Jan. 1975 288 p refs
(Grant NSF GI-38977)
(PB-252353/8; NSF/RA/E-75-115) Avail: NTIS HC $9.25 CSCL 13B

The relations of costs and revenues in a small suburban town to the major observable determinants are examined. The results are incorporated into a projection method which produces estimates useful to a local decision maker. Author

N76-30693# Worcester Polytechnic Inst., Washington, D. C. Project Center.

A METHODOLOGY FOR COMPARATIVE EVALUATION OF WATER QUALITY INDICES Final Report

William E. Booth, Paul C. Carubia, and Francis C. Lutz 1976 163 p refs Sponsored by Council on Environ. Quality
(PB-251572/4; EQ-245216336312) Avail: NTIS HC $6.75 CSCL 13B

A methodology for critically evaluating a water quality interpretive technique that employs physical-chemical measurements is developed and applied in the evaluation of two indices. Considerations include the scientific validity, sensitivity, and data availability of each technique. The study also identifies means of conveying water quality information. GRA

N76-30694# Pacific Environmental Services, Inc., Santa Monica, Calif.

EMISSIONS FROM HOT-DIP GALVANIZING PROCESSES Final Report

Peter J. Drivas Mar. 1976 60 p refs
(Contract EPA-68-01-3156)
(PB-251910/6; EPA-905/4-76-002) Avail: NTIS HC $4.50 CSCL 07A

A literature review and source tests were performed in order to accurately characterize emissions from hot-dip galvanizing processes. Particulate emission data from seventeen source tests on hot-dip galvanizing plants were considered relevant in developing an emission factor for galvanizing kettles. There was no significant difference between kettle emissions and emissions from control devices. Considering both kettle and control device emissions as one data base, two types of emission factors were calculated. Using the derived emission factors, the total amount of particulate emissions produced by hot-dip galvanizing operations in the United States is estimated to be approximately 1,600 metric tons per year. GRA

N76-30695# Radian Corp., Austin, Tex.

SAMPLING AND ANALYTICAL STRATEGIES FOR COMPOUNDS IN PETROLEUM REFINERY STREAMS, VOLUME 1 Final Report, May - Aug. 1974

K. J. Bombaugh, E. C. Cavanaugh, J. C. Dickerson, S. L. Keil, and T. P. Nelson Jan. 1976 140 p refs
(Contract EPA-68-02-1882)
(PB-251744/9; EPA-600/2-76-012A) Avail: NTIS HC $6.00 CSCL 07A

A general sampling and analytical strategy, developed for use in the identification of potentially hazardous components in process and waste streams is described. The strategy includes sampling, separation, and measurement, with options for different stream types. The strategy was applied to five petroleum refinery streams: fugutive emissions from atmospheric crude distillation, aqueous condensate from an atmospheric crude still, effluent water from an API separator, tail gas from a sulfur recovery unit, and atmospheric emissions from a fluid catalytic cracking regenerator. GRA

N76-30696# Aerospace Corp., El Segundo, Calif.

REUSE OF POWER PLANT DESULFURIZATION WASTE WATER Final Report, Jan. 1974 - Apr. 1975

L. J. Bornstein, R. B. Fling, F. D. Hess, R. C. Rossi, and J. Rossoff Feb. 1976 135 p refs
(Grant EPA-R-802853)
(PB-250732/5; EPA-600/2-76-024) Avail: NTIS HC $6.00 CSCL 13B

Results are presented of an assessment of the potential reuse of liquor from nonregenerable flue gas desulfurization systems by applying available water treatment processes. Chemical characterizations were performed on liquors from four different scrubbers; these were assessed for use as power plant service water or for direct discharge. Treatment is required for either use; but, in most cases (for economic reasons), treatment for discharge is not recommended. Chemical precipitation (e.g., lime-soda softening, filtration, and pH control) is adequate for most service water usage cases. The applicabilities of available treatment systems are given, in addition to scrubber flow diagrams, water balance, and treatment costs for a range of liquor flow rates. GRA

N76-30697# Battelle Inst., Frankfurt am Main (West Germany).
AIR POLLUTION: PROCEEDINGS OF THE 6TH INTERNATIONAL TECHNICAL MEETING ON AIR POLLUTION MODELING AND ITS APPLICATION
Brussels NATO Comm. on the Challenges of Modern Soc. 1975 757 p refs Conf. held at Frankfurt am Main, 24-26 Sep. 1975 Sponsored by NATO
(PB-251328/1; NATO/CCMS-42) Avail: NTIS HC $18.75 CSCL 13B

The five main areas discussed at this meeting and reported on are: (1) current and future application of air pollution modeling and accuracy requirements; (2) requirements of standardization of air quality simulation models and requirements of a common data base for air quality simulation models; (3) validation of air quality simulation models; (4) regional and interregional dispersion models; (5) new modeling techniques. GRA

N76-30698# Research Triangle Inst., Research Triangle Park, N.C.
GUIDELINES FOR DEMONSTRATION PROJECT QUALITY ASSURANCE PROGRAMS Final Report
James Buchanan Mar. 1976 63 p ref
(Contract EPA-68-02-1398)
(PB-252257/1; EPA-600/2-76-081) Avail: NTIS HC $4.50 CSCL 07A

The major components of a project quality control program are addressed, including a discussion of quality control in the request for proposal, the proposal, and the work plan. The two major functional areas of quality assurance are the qualitative systems review and the quantitative performance audit. A detailed checklist is provided to aid in the systems review, and three tables provide general information on available techniques for the performance audit. These tables cover the auditing of physical measurements, gas effluent streams, and liquid process streams. GRA

N76-30699# Alabama Univ., University. Dept. of Biology.
DEGRADATION OF PESTICIDES BY ALGAE Final Report
Joseph C. Okelley and Temd R. Deason Mar. 1976 51 p refs
(Grant EPA-R-800371)
(PB-251933/8; EPA-600/3-76-022) Avail: NTIS HC $4.50 CSCL 06F

Interactions of 12 pesticides with 37 strains of fresh water algae were studied in an effort to determine something of the variability in responses of fresh water algae to the variety of pesticides in use or projected to be used in the future. Three interactions were investigated. One was the toxicity of the pesticides to these algae. Another was the sorption of several of the pesticides by some of the species of algae. The third was the possibility that some of the pesticides can be degraded by action of algae. In general, it was found that sensitivity of algae to pesticides varied greatly with the strains tested. Sorption of methoxychlor appeared to be mainly physical, since much of the methoxychlor sorbed was exchangeable. GRA

N76-30700# Booz-Allen and Hamilton, Inc., Bethesda, Md.
MANUAL OF INSTRUCTIONS FOR PROJECTING EMISSIONS IN SMALL GEOGRAPHIC AREAS: PRELIMINARY TEST USING BALTIMORE AQMA DATA Final Report
Jan. 1975 81 p refs
(Contract EPA-68-02-1005)
(PB-251559/1; EPA-450/3-76-006) Avail: NTIS HC $5.00 CSCL 13B

Guidance and direction are provided for developing and improving a comprehensive emission inventory and for projecting future emissions at the county level. It is divided into four chapters: background information on emission source categories and forecast techniques and an introduction to the content of the Manual; a summary of the data sources referenced in the Manual; specific procedures, data sources and tabulating formats for updating or creating a point and area source emission inventory; specific procedures, data sources and tabulating formats for developing growth factors to project present activity and emissions into the future. GRA

N76-30701# California Univ., Livermore. Lawrence Livermore Lab.
COMPARATIVE METHYLATION CHEMISTRY OF PLATINUM, PALLADIUM, LEAD, AND MANGANESE Final Report, Jul. 1974 - Jun. 1975
Robert T. Taylor Mar. 1976 35 p refs
(PB-251553/4; EPA-600/1-76-016) Avail: NTIS HC $4.00 CSCL 06A

The potential for platinum, palladium, lead, and manganese salts and oxides is evaluated for biochemical methylation. Salts of platinum, palladium, and lead, and oxides of lead all containing the metal in A +4 valence were observed to demethylate methylcobalamin, a biologically active form of vitamin B-12. The reaction product formed from methylcobalamin and hexachloroplatinate was shown definitively to be a monomethyl-platinum compound. It is sufficiently stable in aqueous solutions under a variety of conditions to exist in freshwater ecosystems and to exhibit toxic effects on mammalian cells. GRA

N76-30702# Enviro Control, Inc., Rockville, Md.
CRITICAL REVIEW OF AIR POLLUTION DOSE-EFFECT FUNCTIONS Final Report
A. Hershaft, J. Morton, and G. Shea Mar. 1976 216 p refs Sponsored in part by EPA
(PB-251519/5; EQ-517513012) Avail: NTIS HC $7.75 CSCL 06F

An assessment of the state of the art in developing air pollution dose effect functions is given and recommendations, for improving analytical methods are discussed. The pollutants are; total suspended particulates, sulfur dioxide, nitrogen dioxide, photochemical oxidants, carbon monoxide, hydrocarbons, sulfates, nitrates, and fluorides. Physical and biological effects, both chronic and acute, encompass health effects, vegetation and materials damage, aesthetic impairment, and climatic changes. GRA

N76-30703# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
GUIDELINES FOR EVALUATING SUPPLEMENTARY CONTROL SYSTEMS Final Guideline Series Report
Feb. 1976 78 p refs
(PB-251558/3; EPA-450/2-76-003; OAQPS-1.2-036) Avail: NTIS HC $5.00 CSCL 13B

Through a supplementary control system (SCS), SO2 emissions from a facility are temporarily curtailed when meteorological conditions conducive to high ambient SO2 concentrations exist or are anticipated. The purpose of the document is to provide guidance to facilities proposing to use SCS and to air pollution control agencies in their case-by-case evaluation of such systems to determine if the proposed systems will ensure attainment of air quality standards. The document provides specific guidance on (1) technical considerations with such systems, (2) meteorological conditions conducive to high ambient pollutant concentrations, (3) the application by the source to use an SCS, and (4) the development and implementation of such systems. GRA

N76-30704# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
GUIDELINES FOR AIR QUALITY MAINTENANCE PLAN-

NING AND ANALYSIS. VOLUME 9: EVALUATING INDIRECT SOURCES
Jan. 1975 509 p
(PB-251619/3; EPA-450/4-75-001; OAQPS-1.2-028) Avail: NTIS HC $12.75 CSCL 13B

In formulating and implementing an air quality maintenance plan, it may frequently be desirable to include provisions for new source review. One type of new source is the indirect source. This document presents a screening procedure that may be useful in assessing the maximum impact of a proposed indirect source on roadside concentrations of carbon monoxide. The screening procedure is intended to be conservative so that if no potential problem is identified, there may be reasonable assurance that none will occur. Specific suggestions are made concerning estimation of carbon monoxide (CO) concentrations in the vicinity of signalized and unsignalized intersections as well as near locations where traffic is freely flowing. More detailed discussions concerning the estimation of emissions of CO in and around parking lots are contained in appendices. GRA

N76-30705# Environmental Protection Agency, Research Triangle Park, N.C.
EFFECTS OF GASEOUS POLLUTANTS ON MATERIALS: A CHAMBER STUDY
R. H. Haynie, J. W. Spence, and J. B. Upham Feb. 1976 98 p refs
(PB-251580/7; EPA-600/3-76-015) Avail: NTIS HC $5.00 CSCL 14B

Controlled environment exposure chambers were used to assess the effects of sulfur dioxide, nitrogen dioxide, and ozone on a variety of materials. Materials included weathering steel, galvanized steel, aluminum alloy, paints, drapery fabrics, white sidewall tire rubber, vinyl house siding, and marble. The exposure experiment was statistically designed using a two-level factorial arrangement to identify the environmental factors or combination of factors, or both, that cause materials damage. Over 200 different direct and synergistic effects were examined. The study revealed that only 22 of the possible effects were statistically significant at better than a 95 percent confidence level. Sulfur dioxide, relative humidity, and the interaction between them, were the main factors causing effects. A number of empirical functions were developed that relate materials effects to various factors causing the effects. The lack of statistical significance that was found for the large majority of effects that were studied is equally as important as the significant effects. GRA

N76-30706# GCA Corp., Bedford, Mass. Technology Div.
PRELIMINARY EMISSIONS ASSESSMENT OF CONVENTIONAL STATIONARY COMBUSTION SYSTEMS. VOLUME 1: EXECUTIVE SUMMARY Final Task Report, Mar. - Nov. 1975
Norman Surprenant, Robert Hall, and Leonard M. Seale Mar. 1976 86 p refs
(Contract EPA-68-02-1316)
(PB-251612/8; GCA-TR-75-26-G-Vol-1; EPA-600/2-76-046a) Avail: NTIS HC $5.00 CSCL 13B

Results are given of a preliminary emissions assessment of the air, water, and solid waste pollutants produced by conventional stationary combustion systems. The results are summarized in four principal categories: utilities (electric generation), industrial (steam generation, space heating, and stationary engines), commercial/institutional (space heating and stationary engines), and residential (space heating). For each principal combustion system category, the report summarizes: process types and operating efficiencies, fuel consumption, pollutant sources and characteristics, major research and development trends, fuel consumption trends, and technical areas where emission data are incomplete. It also summarizes the pollutant emissions from applicable unit operations for each of 56 source classifications, using a uniform combustion source classification system.
Author (GRA)

N76-30707# Michigan Univ., Ann Arbor.
OZONE AND PARTICULATE FORMATION IN PHOTOCHEMICAL REACTIONS Final Report
Chi-Hung Shen and George S. Springer Apr. 1975 139 p refs
(Grant EPA-R-801476)
(PB-251587/2; EPA-460/3-76-005) Avail: NTIS HC $6.00 CSCL 07E

Experiments were performed to investigate the photochemical formation of nuclei and aerosols in sulfur dioxide-air mixtures and the photochemical formation of ozone, nuclei, and aerosols in cyclohexene-nitrogen dioxide-air mixtures. The mixtures were irradiated by ultraviolet fluorescent lamps while flowing at a steady speed through a 9.12 m long and 15.2 cm i.d. Pyrex tube. The amounts of ozone, nuclei, and aerosols generated in the gas-air mixtures were measured at various points along the tube by a chemiluminescent analyzer, a condensation nuclei counter, and an aerosol counter. Photooxidation experiments with sulfur dioxide-air mixtures were performed for five different initial sulfur dioxide concentrations (0.2, 0.3, 0.5, 0.7, and 1 ppm) and for four relative humidities (25, 50, 75, and 100 percent). The data showed that the maximum number of nuclei produced is directly proportional to the initial sulfur dioxide concentration and to the square of the relative humidity. GRA

N76-30708# Olson Labs., Inc., Anaheim, Calif.
DEGRADATION EFFECTS ON MOTOR VEHICLE EXHAUST EMISSION Final Report
John Gunderson Mar. 1976 228 p refs Sponsored by Air Resources Board, Sacramento, Calif.
(PB-251538/5; ARB-3-199/3-584-76-41) Avail: NTIS HC $8.00 CSCL 13F

A study was conducted to determine the effects of vehicle maintenance practices on exhaust emissions. Four groups of 144 1968 to 1974 light duty vehicles, representative of California's population in 1975 were evaluated. The groups represented (1) a control group, (2) a 50 percent pass-fail idle test inspection, (3) manufacturers specification and (4) mandatory maintenance and parameter inspection. All vehicles entering the test program received a baseline 1973 Federal CVS emission test, followed by a hot-idle test (low and 2,500 rpm). Adjustment or repair of vehicles was accomplished by Olson Laboratories for Group II and Group III vehicles. Class A garages performed maintenance on Group IV vehicles. Following the necessary maintenance, the Federal and idle tests were repeated for Group II, Group III, and Group IV vehicles. All vehicles in these groups were retested at 1-, 2-, 6-, 9- and 12-month intervals. This report documents the results of the test program. GRA

N76-30709# Olson Labs., Inc., Anaheim, Calif.
GUIDELINES FOR QUALITY ASSURANCE PROGRAMS FOR MOBILE SOURCE EMISSIONS MEASUREMENT SYSTEMS. PHASE 4: HEAVY-DUTY GASOLINE ENGINES, QUALITY ASSURANCE GUIDELINES Final Report
Harold Wimette, Rod Pilkington, and Tom Kelly Jun. 1975 43 p refs
(Contract EPA-68-02-1740)
(PB-251564/1; EPA-650/4-75-0246) Avail: NTIS HC $4.00 CSCL 13F

Quality Assurance guidelines for Light Duty Gasoline Powered Mobile Source Emissions Measurement Systems are presented with the concept of a total Quality Assurance System. The guidelines apply to Quality Assurance principles and techniques in the areas of procurement, standards and calibration, test quality control, data validation and corrective action. Model Quality Management Procedures are presented to describe the relationships and responsibilities of the various organizational elements in accomplishing the quality functions. GRA

N76-30710# Olson Labs., Inc., Anaheim, Calif.
GUIDELINES FOR QUALITY ASSURANCE PROGRAMS FOR MOBILE SOURCE EMISSIONS MEASUREMENT SYSTEMS. PHASE 4: HEAVY-DUTY GASOLINE ENGINES, TEST PROCEDURES Final Report
Harold Wimette, Rod Pilkington, and Tom Kelly Jun. 1975 37 p
(Contract EPA-68-02-1740)
(PB-251565/8; EPA-650/4-75-024h) Avail: NTIS HC $4.00 CSCL 13F

Test procedures for Heavy Duty Gasoline Engines Mobile Source Emissions Measurement Systems are presented with the concept of a total quality assurance system. The test procedures are presented in document control format and give the detailed test procedures with quality assurance provisions for each part

of the total testing system. This volume is a supplement to EPA-650/4-75-024-d, Guidelines for QA Programs for Mobile Source Emission Measurement Systems, Phase II, Heavy Duty Diesel Engines - Test Procedures. GRA

N76-30711# Environmental Protection Agency, Washington, D.C.
SUMMARY OF PARTICULATE AND SULFUR OXIDE EMISSION REDUCTIONS ACHIEVED NATIONWIDE FOR SELECTED INDUSTRIAL CATEGORIES, 1970 - 1974 Final Report
Jan. 1976 36 p ref
(PB-252249/8; EPA-340/1-76-001) Avail: NTIS HC $4.00 CSCL 13B

This report summarizes the results of four years of local, state, federal, and industry efforts to reduce the amount of particulates and sulfur oxides being emitted into the atmosphere by stationary sources of air pollution. Emission reductions for selected industrial categories are summarized and compared to the reduction goal planned for the time period. Results are presented in both graphic and tabular form and are discussed separately for each pollutant and each industry as well as for the nation as a whole. GRA

N76-30712# Acurex Corp., Mountain View, Calif. Aerotherm Div.
CATALYTIC OXIDATION OF FUELS FOR NOx CONTROL FROM AREA SOURCES Final Task Report, Oct. 1974 - Apr. 1975
J. P. Kesselring, R. A. Brown, R. J. Schreiber, and C. B. Moyer Feb. 1976 194 p refs
(Contract EPA-68-02-1318)
(PB-252195/3; EPA-600/2-76-037) Avail: NTIS HC $7.50 CSCL 13A

Results are presented of a review of the state-of-the-art of catalytic combustion concepts, and of an assessment of the applicability of catalytic combustion to gas-and-oil-fired home heaters and commercial and industrial boilers. Newly developed high-temperature support materials will greatly enhance the field of high-temperature catalytic combustion, but current catalyst systems are limited by the catalyst coating to much lower temperatures than the supports. To keep combustor temperatures below those that would cause catalyst degradation, to achieve high system efficiency, and to prevent NOx formation, combustion system concepts such as two-stage combustion, flue gas recirculation, and bead heat removal appear necessary. GRA

N76-30713# Rockwell International Corp., Canoga Park, Calif. Rocketdyne Div.
CHEMISTRY OF FUEL NITROGEN CONVERSION TO NITROGEN OXIDES IN COMBUSTION Final Report, Jun. 1972 - May 1975
A. E. Axworthy, G. R. Schneider, M. D. Shuman, and V. H. Dayan Feb. 1976 365 p refs
(Contract EPA-68-02-0635)
(PB-250373/8; R-9698) Avail: NTIS HC $10.50 CSCL 13B

The chemical mechanisms involved in the conversion of fuel nitrogen to NOx in combustion were investigated. The pyrolysis of fossil fuels and model fuel nitrogen compounds was investigated, droplet and particle combustion models were developed, and premixed flat-flame burner experiments were conducted to study the conversion of HCN and NH3 to NOx in low-pressure CH4-O2-Ar flames. Decomposition rates and products were measured in helium from 850 to 1100C for pyridine, benzonitrile, quinoline, and pyrrole; products were measured for fuel oils, crude oil, and coal. HCN was the major nitrogen-containing pyrolysis product: the amount formed increased with temperature. NH3 was a minor product and little if any N2 was formed. Fuel NO forms relatively slowly above the luminous zone in the same region where CO is oxidized to CO2 or later. Although HCN and NH3 gave similar yields of NO, the NH3 reacted very early in the flame front; most of the HCN survived the luminous zone and then reacted slowly. A mechanism was proposed in which fuel NO forms via the reaction: O + NCO = NO + CO. GRA

N76-30714# Southwest Research Inst., San Antonio, Tex.
MASS EMISSIONS FROM TEN PRE-CONTROLLED GASOLINE TRUCKS, AND COMPARISON BETWEEN DIFFERENT TRUCKS ON A ROAD COURSE Final Report
M. N. Ingalls and K. J. Springer Apr. 1975 401 p refs
(Contract EPA-68-03-0441)
(PB-251586/4; EPA-460/3-75-004) Avail: NTIS HC $11.00 CSCL 13B

Exhaust emission and fuel economy tests were performed on ten 1965-1969 pre-emission-controlled gasoline-powered heavy-duty trucks while being operated over the San Antonio road route. Each vehicle was also emission tested using a 9-mode chassis dynamometer test procedure. Comparisons were made on emission data between these two test procedures as well as emission data and fuel-economy data from two other heavy-duty testing projects. GRA

N76-30715# Tulsa Univ., Okla.
DISPOSAL OF SOLUBLE INORGANIC SALTS
Francis S. Manning and Nicholas D. Sylvester 1974 9 p refs Prepared in cooperation with Oklahoma Water Resources Research Inst., Stillwater. Sponsored by Department of the Interior, Office of Water Research and Technology
(PB-251556/7; W76-06156) Avail: NTIS HC $3.50 CSCL 13B

Dynamic hydrous oxide membranes, recently developed at Oak Ridge National Laboratory, offer the possibility of removing total dissolved solids and of separating monovalent ions from polyvalent ones during concentration, thus creating new possibilities for later steps such as fractional crystallization. The goal of this research project was the design and construction of a laboratory flow cell system for the evaluation of these dynamic hydrous oxide membranes. The flow system has been designed, constructed, and evaluated on a preliminary basis. A schematic diagram of the entire experimental flow system is presented. GRA

N76-30716# Virginia Polytechnic Inst. and State Univ., Blacksburg. Virginia Water Resources Research Center.
NITROGEN, PHOSPHORUS AND CARBON FLUX IN CHESAPEAKE BAY MARSHES
Kenneth A. Moore and Michael E. Bender Jan. 1976 185 p refs Sponsored by the Department of the Interior, Office of Water Research and Technology
(PB-251549/2; VPI-VWRRC-Bull-79; W76-06162; OWRT-B-027-VA(2)) Avail: NTIS HC $5.00 CSCL 08J

Annual nitrogen, phosphorous and carbon budgets for two Virginia salt marshes were determined by monthly measurements of water discharge and constituent concentrations over tidal cycles. Considering all three forms of phosphorus measured (total, dissolved organic and orthophosphate) there was a net loss from the estuary to the marshes. The data reveal a loss of particulate phosphorous of estuarine origin to marsh sediments and mineralization of this phosphorus in the marshes with subsequent export of dissolved inorganic and organic phosphorus back to the estuary. Nitrogen flux data show a loss of nitrate and nitrite to the marshes. Carbon flux data show significant contributions of both particulate and dissolved organic carbon to the estuary from the marshes. GRA

N76-30717# Vent-O-Matic Incinerator Corp., North Quincy, Mass.
DEVELOPMENT OF MULTI-USE SHIPBOARD INCINERATOR: TEST PROGRAM AND ANALYSIS, PHASE 1 Final Report
30 Jan. 1976 58 p
(Contract N00024-75-C-4199)
(AD-A022444) Avail: NTIS CSCL 13/2

The report covers the test program carried out on a newly designed multi-use shipboard incinerator. Test procedures and the test stand are described and the test results analyzed in detail. After a series of shake-down tests a formal test program was started consisting of three phases, (a) 24 Factorial Tests, (b) six Replication Tests, and (c) twelve Capacity Tests. The Factorial and Replication Tests were done with simulated refuse, waste and sewage for a set feeding period of 5-1/2 hours. The Capacity Tests were conducted with actual municipal wastes for a feeding period of 10 hours plus additional time required to incinerate 400 gal. of sewage. The results of the extensive test program proved the soundness of the design concept and

demonstrated the capability of the unit to meet the contract capacities. GRA

N76-30718# Versar, Inc., Springfield, Va.
ASSESSMENT OF WASTEWATER MANAGEMENT, TREATMENT TECHNOLOGY, AND ASSOCIATED COSTS FOR ABATEMENT OF PCBs CONCENTRATIONS IN INDUSTRIAL EFFLUENTS, TASK 2 Final Report
Gayaneh Contos, Robert L. Durfree, E. E. Hackman, III, and Kenneth Price 30 Jan. 1976 282 p refs
(Contract EPA-68-01-3259)
(PB-251433/9; EPA-560/6-76-006) Avail: NTIS HC $9.25 CSCL 13B

The findings are reported of a study of available wastewater management and treatment technology for the purpose of determining toxic pollutant effluents concentrations and daily load achievable in three industrial categories. For scrap oils and burnable solid wastes generated at these plants, high temperature, controlled incineration offers a straightforward method of destruction. Zero discharge objectives can be best achieved by eliminating discharge streams and developing recycle systems. All non-contact cooling water would be segregated, cooled, and recylced. All other wastewater streams would be pretreated. The portion of the pretreated water which would be used in the plant would be treated with carbon, while the excess water would be incinerated in a specially designed system which would allow for energy recovery. GRA

N76-30719# Environmental Protection Agency, Washington, D.C. Office of Noise Abatement and Control.
STATE AND MUNICIPAL NOISE CONTROL ACTIVITIES, 1973-1974
Jan. 1976 174 p
(PB-251999/9; EPA-550/9-76-006) Avail: NTIS HC $6.75 CSCL 13B

Presented is an assessment of 1973-1974 state and municipal environment noise control efforts based on an EPA survey of states and municipalities with populations greater than 75,000. This assessment is designed to provide an overall perspective of the composition and scope of noise control efforts. Areas covered are organization and orientation of noise control efforts, enforcement, budgetary data, personnel, equipment, program problems, and application of technical assistance. The survey results have been used by EPA/ONAC as a guide in the present technical assistance program. This diocument has been prepared primarily as a planning and reference guide for public administrators and other officials engaged in the development and implementation of environmental noise control programs. GRA

N76-30720# System Sciences, Inc., Palo Alto, Calif.
SYSTEM FOR TABULATING SELECTED MEASURES OF STATE AIR PROGRAMS STATUS Final Report
Marsha N. Allgeier and Barry Levene Apr. 1975 266 p ref
(Contract EPA-02-1420)
(PB-251752/2; EPA-450/3-75-055) Avail: NTIS HC $9.00 CSCL 13B

A system for tabulating selected measures of state air programs status was developed to provide a method for organizing, summarizing, and presenting within a coherent framework, data from existing reporting systems available to EPA headquarters. The system consists of a framework of measures of selected aspects of state air programs for which data is readily available, a methodology for computing values and scores for these measures, and alternative formats for summarizing and presenting values and scores. A trial run of the system was conducted for all fifty-five state and territorial control programs to demonstrate the manual application of the system. It was concluded that a periodic manual application of the system is feasible but time-consuming. The feasibility of automating the system depends on the extent of system usage and the degree of stability of data items and measures. GRA

N76-30721# Battelle Memorial Inst., Columbus, Ohio.
WATER POLLUTION ABATEMENT TECHNOLOGY CAPABILITIES AND COSTS SELECTED INDUSTRIES. INDUSTRY CATEGORY 1A: ORE MINING AND MILLING Final Report
Jul. 1975 2603 p
(Contract WQ5AC012)
(PB-251437/0; NCWQ-75/89-1) Avail: NTIS HC $95.75 CSCL 13B

Technologies are examined for thirty eight (38) industry segments to meet water pollution abatement requirements of the Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500). Levels of pollution abatement which are reviewed include those promulgated by the U. S. Environmental Protection Agency for 1977 (PBCTCA or best practicable control technology currently available) and for 1983 (BATEA or best available technology economically achievable). Capital and operating and maintenance costs are presented in 1973 dollars. Performance is stated in terms of resulting effluents. GRA

N76-30722# Environmental Quality Systems, Inc., Rockville, Md.
REPORT TO THE NATIONAL COMMISSION OF WATER QUALITY ON THE ENVIRONMENTAL IMPACT OF THE DISPOSAL OF WASTEWATER RESIDUALS, VOLUME 1 AND 2 Final Report
Mar. 1976 1031 p refs
(Contract WQ5AC072)
(PB-251371/1; NCWQ-75/79-Vol-1; NCWQ-75/79-Vol-2) Avail: NTIS HC $28.25 CSCL 13B

The impact to the nation and 'minimum geographical areas' of the disposal of residues produced from wastewater treatment was evaluated. Land disposal of sludges and treated effluent were emphasized. Incineration and ocean disposal of sludges were also considered. Based on a review of residue production by treatment of manufacturing processes, municipal and industrial residue generation rates and locations were estimated. Impacts on natural vegetation, wildlife and groundwater were evaluated for land disposal techniques. Impacts on air quality were evaluated for incineration of sludge as well as air stripping for ammonia removal from sewage. Ocean disposal was considered both in general and with emphasis on the New York Bight. It was concluded that local impacts of land disposal could be controlled and minimized with careful site selection and development and carefully controlled application rates. Incineration and air stripping systems can cause air pollution problems if not properly designed, located and operated. GRA

N76-30723# Virginia Polytechnic Inst. and State Univ., Blacksburg. Water Resources Research Center.
MODELING THE EFFECTS OF WASTE DISCHARGES IN A SMALL MOUNTAIN STREAM
Robert C. Hoehn, Mitchell R. Childrey, and Dinshaw N. Contractor Sep. 1975 93 p refs Sponsored in part by HEW
(PB-251392/7; VPI-VWRRC-Bull-76; W76-05834) Avail: NTIS HC $5.00 CSCL 13B

The research evaluated the applicability of a particular computer model, designed to predict dissolved oxygen (DO) and biochemical oxygen demand (BOD) concentrations in rivers, to similar studies of a small mountain stream in southwestern Virginia. The river model was developed by the Virginia State Water Control Board's Bureau of Water Control Management. A detailed explanation of the necessary computations involved, the methods used to obtain all necessary input data, and modifications that were made in the original model to adapt it for use with a small stream are presented. Also included is a discussion of a modified sensitivity analysis of the model performed to identify which input parameters, if varied slightly, would affect the model's DO and BOD predictions. Finally, data are presented showing that the modified version of the model is capable of predicting measured DO and BOD concentrations in the stream. GRA

N76-30724# Environmental Protection Agency, Washington, D.C. Office of Noise Abatement and Control.
BACKGROUND DOCUMENT FOR RAILROAD NOISE EMISSION STANDARDS Final Report
Dec. 1975 572 p
(PB-251713/4; EPA-550/9-76-005) Avail: NTIS HC $13.50 CSCL 13B

The document contains the technical, economic, health and welfare analyses and other pertinent data and information used by the Environmental Protection Agency in the development of the final interstate Rail Carrier Noise Emission Regulation. GRA

N76-30725# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
MODELING OF THE EFFECTS OF POLLUTANTS AND DISPERSION IN URBAN ATMOSPHERES Final Report, 1 Jun. 1971 - 31 Jan. 1975
R. Viskanta, R. W. Bergstrom, Jr., and R. O. Johnson Feb. 1976 126 p refs
(Grant EPA-R-801102)
(PB-251696/1; EPA-600/4-76-002) Avail: NTIS HC $6.00 CSCL 13B

The short-term effects of radiatively participating pollutants upon the thermal structure and dispersion in an urban atmosphere were studied by constructing one- and two-dimensional transport models for the planetary boundary layer. Special attention was focused on the interaction of solar and thermal radiation with gaseous and particulate pollutants as well as natural atmospheric constituents. GRA

N76-30726# Development Planning and Research Associates, Inc., Manhattan, Kans.
WATER POLLUTION CONTROL ACT OF 1972. ECONOMIC IMPACTS LEATHER TANNING INDUSTRY Final Report
Nov. 1975 129 p refs
(Contract WQ5AC011)
(PB-250019/7; NCWQ-75/42) Avail: NTIS HC $6.00 CSCL 13B

The economic impacts on the leather tanning industry of achieving the 1977 (BPT) and 1983 (BAT) limitation requirements of the Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500) were assessed. The capital requirements for the industry total over $58 million with annual O and M costs of almost $15 million for plants requiring pretreatment and BPT. The additional amounts needed for BAT controls are $35 million capital and over $6 million O and M. Resulting price increases will be an estimated 1.6% over baseline in 1977 and 2.2% over baseline in 1983. Production lost from plant closures as a result of the Act is estimated at less than 10% of industry volume. As a result of plant closures, industry employment will be 950 less than baseline in 1977 and 925 less than baseline in 1983.GRA

N76-30727# Minnesota Pollution Control Agency, Roseville.
CHEMICAL WASTE LAND DISPOSAL FACILITY DEMONSTRATION GRANT APPLICATION Interim Report
1976 183 p refs Prepared in cooperation with Barr Engineering Co., Minneapolis, Minn.
(Grant EPA-S-803744)
(PB-249747/7; EPA-530/SW-87d.i) Avail: NTIS HC $7.50 CSCL 13B

The U.S. Environmental Protection Agency has awarded the Minnesota Pollution Control Agency a grant to demonstrate land disposal techniques for potentially hazardous chemical wastes (solids, sludges, and slurries). This document presents the demonstration approach as it is proposed in the grantee's application. The application identifies and discusses: work tasks, potential facility designs, personnel needs, budget needs, contractor/consultant arrangements, implementation procedures, evaluating and reporting procedures, and the existing regulatory framework. GRA

N76-30728# Environmental Protection Agency, Kansas City, Mo.
WASTEWATER LABORATORY PROCEDURES AND CHEMISTRY
Jan. 1975 218 p
(PB-251828/0; EPA-907/9-75-002) Avail: NTIS HC $7.75 CSCL 14B

This manual has been adapted from Chapter 14 of 'Operation of Wastewater Treatment Plants - A Field Study Course' for limited distribution in Region VII. This manual is intended to serve as a training reference material for personnel of the Regional Surveillance and Analysis Program to assist them in providing assistance to treatment plant operators who have been identified as being in need of greater skills to perform necessary laboratory analyses. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N76-30729 Maryland Univ., College Park.
INFLUENCE OF THE DIABATIC HEATING AND TRANSIENT EDDY EFFECTS ON THE MEAN AXIALLY-ASYMMETRIC COMPONENT OF A MODEL ATMOSPHERE Ph.D. Thesis
Leonard Levin 1975 148 p
Avail: Univ. Microfilms Order No. 76-18825

The effects of transient eddies on the maintenance of the standing eddy circulation of the atmosphere are studied using a two-layer baroclinic model. Linearized perturbation equations for the time-averaged axially-asymmetric meridional velocity are derived, in which the zonally-averaged zonal velocity and the zonally-averaged temperature gradient appear as the higher-order coefficients, assumed known from observation. Nonlinear time-averaged transient eddy flux divergence terms and diabatic heating, also appearing in the perturbation equations, are found from observation. Three cases were investigated, corresponding to the three types of forcing field available: diabatic heating acting alone, transient eddy flux divergences acting alone, and heating and eddy divergences combined. When the coefficients of the equations are used with midlatitude values, transient eddy effects are found to significantly determine the final motion field except in regions of heating or cooling maxima.
Dissert. Abstr.

N76-30730 Washington Univ., Seattle.
SPACE-TIME SPECTRAL ANALYSIS OF LARGE SCALE MID-LATITUDE DISTURBANCES Ph.D. Thesis
Robert Warren Pratt 1975 166 p
Avail: Univ. Microfilms Order No. 76-17592

The problems of interpreting space-time spectral analysis and space-time Fourier analysis results are discussed. It is shown that is it difficult to separate the effects of zonally propagating waves from zonally fixed standing oscillations, or in some cases to differentiate between the effects of eastward and westward propagating waves on the space-time spectra. It is concluded that the most unambiguous space-time spectral quantities are those which are one-sided, rather than two-sided, in frequency. Tables of one-sided space-time spectra based on four seasons of winter mid-latitude tropospheric data are presented. The major features of the tables are discussed, in particular comparisons between zonal and meridional wind components, and between northward heat flux and momentum flux, in the wavenumber-frequency domain. Some examples of summer spectra are shown. Dissert. Abstr.

N76-30731 Clarkson Coll. of Technology, Potsdam, N.Y.
A STUDY ON THE DIFFUSION OF ATMOSPHERIC PARTICLES TOWARDS A ROTATING DISK Ph.D. Thesis
Prabhakar D. Paranjpe 1976 161 p
Avail: Univ. Microfilms Order No. 76-18852

Atmospheric aerosol diffusion to a rotating disk, spinning at constant angular speed in an infinite still medium, is studied under laminar and turbulent fluid flow conditions. Aerosol samples collected at the disk surface were analyzed by electron microscopy to determine size distribution of deposited particles in the range .025 to 0.6 microns in radius. This information was then processed using appropriate theoretical diffusion models to arrive at ambient particle size distribution and/or ambient particle concentration. It was observed that the filtration results were consistently lower than the predicted values obtained from the rotating disk data. A generalized laminar diffusion model accounting for three transport mechanisms appears to improve the correlation between predicted particulate size distribution and the experimental data. Dissert. Abstr.

N76-30732 Pennsylvania State Univ., University Park.
ELECTRIC FIELDS IN THE IONOSPHERE Ph.D. Thesis
Volker Kirchhoff 1975 149 p
Avail: Univ. Microfilms Order No. 76-17179

F-region drift velocities have been analyzed in terms of diurnal,

seasonal, magnetic activity and solar cycle effects. A comprehensive electric field model has been developed that includes the effects of the E- and F-region dynamos, magnetospheric sources, and the ionospheric conductivities, for both the local and conjugate regions. Through its use the importance of the different sources is determined. The E-region dynamo dominates during the day but at night the F-region dynamo and convection are more important. This model provides much better agreement with observations of the F-region drifts than previous models. Measurements and calculations indicate larger magnitudes at night, and the daily variation is dominated by the diurnal mode. Seasonal variations introduced through variations in conductivities and thermospheric winds indicate a reversal in direction in the early morning during winter. Dissert. Abstr.

N76-30733 Stanford Univ., Calif.
A CRYOGENIC TEST OF THE EQUIVALENCE PRINCIPLE Ph.D. Thesis
Paul Wellman Worden, Jr. 1976 184 p
Avail: Univ. Microfilms Order No. 76-18813

The weak equivalence principle is the hypothesis that the ratio of inertial and passive gravitational mass is the same for all bodies. A greatly improved test of this principle is possible in an orbiting satellite. The most promising experiments for an orbital test are adaptations of the Galilean freefall experiment and the Eoetvoes balance. Limitations to equivalence principle experiments and the usefulness of cryogenic technology in the experiments are discussed. An experimental test of some of the concepts involved in the orbital free-fall experiment is described. The experiment consists in comparing the motions of test masses levitated in a superconducting magnetic bearing, and is itself a sensitive test of the equivalence principle. Dissert. Abstr.

N76-30734 Columbia Univ., New York.
ON THE USE OF INFRASOUND TO MONITOR THE UPPER ATMOSPHERE - THE INFRASOUND TECHNIQUE Ph.D. Thesis
David Harold Rind 1976 408 p
Avail: Univ. Microfilms Order No. 76-17861

The approximate meteorological and oceanographic conditions for infrasound generation are investigated, as well as their location, followed by the theoretical effect of observed atmospheric parameters on the infrasound propagation. A discussion of concurrently generated ground motion, microseisms, is presented with a comparison to microbaroms, to allow for an independent estimate of source conditions. The observed amplitude variations of the recorded infrasound at Palisades, N.Y. are then introduced and related to upper atmosphere effects. Methods of height determination, involving the effects of dissipation, and recovery of the speed of sound at the reflection level are given; these constitute the basis of the infrasound technique. The infrasound observations are then utilized to provide information about wind and temperature effects in the upper atmosphere, and the results are compared with an independently derived model atmosphere. Dissert. Abstr.

N76-30735 Washington Univ., Seattle.
SEDIMENT CHARACTERISTICS OF SOME TEMPERATE GLACIERS Ph.D. Thesis
Hugh Harrison Mills 1975 156 p
Avail: Univ. Microfilms Order No. 76-17567

Sub-environments of temperature alpine glaciers display distinctive sedimentary characteristics. Particle-size distribution, fabric, clast roundness, clast striations, and lithologic composition can distinguish between lodgment till, ablation drift, end-moraine till, recessional-moraine till, and stratified drift of South Cascade Glacier, Athabasca Glacier, and Mount Rainier glaciers. Dissert. Abstr.

N76-30736 Washington Univ., Seattle.
A MULTI-WAVELENGTH DISTANCE-MEASURING INSTRUMENT FOR GEOPHYSICAL EXPERIMENTS Ph.D. Thesis
Larry Edward Slater 1975 149 p
Avail: Univ. Microfilms Order No. 76-17630

A three-wavelength electromagnetic distance-measuring (EDM) instrument that utilizes the dispersive nature of the atmosphere was developed. The instrument simultaneously measures the optical path length at two wavelengths in the optical region of the spectrum and one in the microwave region. The instrument calculates correction terms from the optical path length differences and then computes the corrected baseline distance, eliminating the first order effects of temperature, pressure and water vapor fluctuations along the line. The optical sources are red He-Ne laser (632.8 nm) and a blue He-Cd laser (441.6 nm). A 9.6-GHz microwave source is used for the third wavelength and a minicomputer for computation and control of the instrument. The multi-wavelength distance equations were derived and their sensitivities to the various parameters were analyzed. A new method of ambiguity resolution for limited bandwith high-frequency (microwave) modulation systems was presented. The instrument was field tested and a specific geophysical experiment utilizing the new instrument was suggested. Dissert. Abstr.

N76-30737 Columbia Univ., New York.
STUDIES OF STRONG GROUND MOTION AND THE RUPTURE PROCESS OF EARTHQUAKES Ph.D. Thesis
John Gregg Anderson 1976 137 p
Avail: Univ. Microfilms Order No. 76-17817

Models were computed for displacements in an infinite space from dynamical displacements on a fault. These were doubled to correct approximately for the free surface. Fault dislocations were found which are consistent with ground motions caused by the magnitude 5 1/2 Parkfield, California earthquake of June 27, 1966 and the magnitude 2.2 Blue Mt. Lake earthquake of January 26, 1974. Accelerograms recorded during the Parkfield earthquake were integrated to obtain displacements for comparison with a displacement model to study the rupture process. Accelerograms recorded during that earthquake were integrated to obtain displacements comparison with the model. Other dislocation models for the earthquake were also investigated. The accelerogram from the Blue Mt. Lake earthquake is remarkable for the simplicity of its S-wave pulse. Spectral analysis of the S-wave was conducted. In addition, to calculate the displacements of the surface of a half space, a two step computing scheme was devised. Dissert. Abstr.

N76-30738*# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
RADIATION MEASUREMENTS FROM POLAR AND GEOSYNCHRONOUS SATELLITES Annual Report, 1 Oct. 1974 - 30 Sep. 1975
Thomas H. Vonder Haar Aug. 1976 118 p refs
(Grant NGR-06-002-102)
(NASA-CR-148777) Avail: NTIS HC $5.50 CSCL 04A

Towards understanding the role of radiation in the dynamics of climate, a climatology of radiation budget data has been compiled and several aspects of the problem are under study: (1) minimum albedoes; (2) diurnal variation in cloudiness and the radiation budget; (3) the partitioning of energy loss to space between land, ice, ocean and atmosphere; and (4) the effects of clouds on the radiation budget. Oceanic precipitation using Nimbus 5 microwave data, and a new study of mesoscale applications of satellite infrared temperature and moisture soundings are also described. S.M.

N76-30739*# Atlantic Science Corp., Indialantic, Fla.
GRAVSAT/GEOPAUSE REFRACTION STUDY
S. K. Llewellyn, J. R. Lipofsky, R. B. Bent, G. Nesterzuk, and P. E. Schmid Apr. 1976 65 p refs
(Contract NAS5-20744)
(NASA-CR-144795) Avail: NTIS HC $4.50 CSCL 03A

A refraction study was performed for a ground station network tracking a high altitude spacecraft, and the spacecraft in turn tracking a low orbiting satellite and relaying the orbit data to the ground stations. New techniques were developed for computing ionospheric and tropospheric refraction effects along the satellite link, and the existing NASA/Worldwide Refraction Model was utilized to compute the corrections for the ground link. Tests were performed demonstrating severe refraction conditions. The maximum one-way ionospheric errors were determined as 2.6 m in range and 17 mm/sec in range-rate for the satellite leg at frequencies of 13.5 GHz, and as 24 m and 3 mm/sec for the ground leg at 2.1 GHz. Maximum tropospheric errors for range and range-rate respectively amounted to 260 m and 23 m/sec along the satellite link as the ray passes close

to the earth's surface, and to 130 m and .5 m/sec along the ground link. Author

N76-30740*# California Inst. of Tech., Pasadena. Seismological Lab.
PYROXENES AND OLIVINES: STRUCTURAL IMPLICATIONS OF SHOCK-WAVE DATA FOR HIGH PRESSURE PHASES
Raymond Jeanloz and Thomas J. Ahrens [1975] 31 p refs
(Grants NGL-05-002-105; NSF DES-75-15006)
(NASA-CR-148717; Contrib-2812) Avail: NTIS HC $4.00 CSCL 08G

The nature of the shock-induced, high-pressure phases of olivine and pyroxene rocks is examined in the light of data for the densities of a new class of perovskite-related silicate structures. Also examined are some new Hugoniot and release adiabat data for bronzite. Reexamining available shock data for magnesian pyroxenes and olivines leads to the conclusion that they define a mixed phase (or disequilibrium) region to about the 100 GPa range, related to the kinetics of phase transformation in these silicates. By recognizing this point, certain discrepancies in previous interpretations of shock data can be explained. A set of theoretical Hugonoits for pyroxene and olivine stoichiometry, perovskite-bearing assemblages was constructed based on their properties deduced from high-pressure work, showing that the shock data is compatible with transformations to perovskites in the 45-7- GPa region. Finally, the shock data indicate very similar properties for olivine and pyroxene at high pressures making them both equally likely candidates for the lower mantle. Author

N76-30741*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EQUATORIAL X-RAYS AND THEIR EFFECT ON THE LOWER MESOSPHERE
R. A. Goldberg, W. H. Jones, P. R. Williamson (Calif. Univ., San Diego), J. R. Barcus (Denver Univ., Colo.), and L. C. Hale (Penn. State Univ., Univ. Park) Aug. 1976 12 p refs Presented at 5th Intern. Symp. on Equatorial Aeronomy (ISEA), Townsville, Australia, Aug. 1976 Submitted for publication
(NASA-TM-X-71170; X-912-76-166) Avail: NTIS HC $3.50 CSCL 04A

On the night of May 23/24, 1975, a sequence of rocket and balloon experiments was launched from Chilca Base, Peru (12.5 deg S, 76.8 deg W, magnetic dip = - 0.7 deg). Detailed analysis and comparisons of the data yielded the first direct measurement of lower mesospheric response to a galactic X-ray source. This result could only have been determined at the equator, where cosmic ray background effects are minimal. The objective of the experiments was to seek out the equatorial energetic electron belt, sporadically reported to contain fluxes near auroral levels, measure the bremsstrahlung radiation produced by this particle belt, and determine the influence of this radiation on the middle atmosphere. High altitude rocket payloads (Nike Tomahawk 18.170 and 18.171) were launched to probe the thermosphere during and following the anticipated downward drift period. Each carried an on-axis X-ray scintillation detector and Geiger Mueller energetic electron detectors. Magnetometers and lunar sensors were used to determine payload aspect. Author

N76-30742*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROCEEDINGS OF THE LECTURES BY THE SEISMOLOGICAL DELEGATION OF THE PEOPLE'S REPUBLIC OF CHINA
Paul M. Muller, ed. 1 Aug. 1976 55 p Transl. into ENGLISH from Journal of the Seismological Society of Japan, vol. 51, no. 3, 1976 p 7-41
(Contract NAS7-100)
(NASA-CR-148763; JPL-SP-43-32) Avail: NTIS HC $4.50 CSCL 08K

Papers are presented dealing with prediction and forecasting earthquakes, the Haicheng earthquake of 1975, earthquake resistivity of factory structures, and earthquake studies and actions in China. J.M.S.

N76-30743# Academy of Sciences (USSR), Moscow. Space Research Inst.
ASYMMETRY OF EARTH'S PLASMASPHERE IN DIRECTION NOON-MIDNIGHT FROM DATA OF MEASUREMENTS ON SATELLITES PROGNOZ AND PROGNOZ-2
K. I. Gringauz and V. V. Bezrukikh 1975 21 p refs
(D-217) Avail: NTIS HC $3.50

Plasmaspheric measurements of the ion density as measured onboard Prognoz and Prognoz-2 satellites are described. It has been shown that near noon the plasmapause is at higher L-shells than near midnight. For magnetic quiet and moderately disturbed periods the noon-midnight asymmetry is 1.6; under strong geomagnetic disturbances this asymmetry decreases and almost disappears. Reasons for this difference in position of the dayside and nightside plasmapause can be connected with differences in the direction of the connective plasma motion at dayside and nightside magnetosphere. Models of the distribution of large-scale electric fields in the quiet magnetosphere have to satisfy the condition of the existence of the asymmetrical equipotential surface, the plasmapause having the geometry corresponding to the measurement data. ESA

N76-30744# Mission Research Corp., Santa Barbara, Calif.
AURORAL SIMULATION STUDIES IN SUPPORT OF ICECAP AND EXCEDE. HAES REPORT NO. 24 Final Report, 1 Oct. 1974 - 30 Sep. 1975
Paul W. Tarr and Douglas H. Archer 30 Sep. 1975 157 p refs
(Contract DNA001-74-C-0143)
(AD-A021923; MRC-R-211; DNA-3785F) Avail: NTIS CSCL 04/1

This report describes the results of calculations and comparisons with data from Projects ICECAP and EXCEDE. Data from three auroral events, taken by ICECAP rockets A18.205-1, A10.205-2, and A18.219-1, and supplemented by data from ground-based instrumentation, were compared with results from ARCTIC code and other supporting calculations. Conclusions, especially with respect to SWIR radiation enhancement, and the excitation mechanism involved, are drawn. GRA

N76-30745# ENSCO, Inc., Springfield, Va.
IMPROVED PROCEDURES FOR DETERMINING SEISMIC SOURCE DEPTHS FROM DEPTH PHASE INFORMATION Quarterly Report, 1 Sep. - 30 Nov. 1975
Edward Page and Francis J. Cook Nov. 1975 19 p
(Contract F08606-76-C-0003; ARPA Order 2551)
(AD-A021931; QR-1) Avail: NTIS CSCL 17/10

Seismic Source depth determination techniques, developed under two previous contracts, were formulated into an automated analysis procedure. Differential travel time information, for several propagation modes relevant to the analysis, have been made accessable through 3-D curve fitting. GRA

N76-30746# Lowell Technological Inst. Research Foundation, Mass.
DIGISONDE OBSERVATIONS DURING CHEMICAL RELEASES Final Scientific Report, 1 Oct. 1972 - 30 Jun. 1975
Klaus Bibl and Bodo W. Reinisch Jan. 1976 41 p
(Contract F19628-73-C-0033; AF Proj. 7635)
(AD-A021910; ULRF-378/IP; AFCRL-TR-76-0046) Avail: NTIS CSCL 04/1

Ionospheric observations with a Digisonde system during upper atmosphere chemical releases were carried out at Wallops Island (ALADDIN 74) in June 1974. Ionogram observations were combined with angle of arrival and Doppler measurements. Ionogram data of ALADDIN 72 and 74 were analyzed with reference to the chemical releases. Digital techniques were applied for the processing of the ionospheric data. The mobile digisonde 128 No. 1 was relocated several times between Eglin, Fla., J. F. Kennedy Space Center, Fla., and Wallops Island, Va. GRA

N76-30747# Geological Survey, Menlo Park, Calif.
MULAP: A MULTI-LINEAR ANALYSIS PROGRAM FOR GROUND MOTION STUDIES OF HORIZONTALLY LAYERED SYSTEMS Final Report
Albert T. F. Chen Dec. 1975 38 p refs
(PB-251286-1; USGS-GD-76/004) Avail: NTIS HC $4.00 CSCL 08M

A computer program that analyzes the nonlinear, dynamic response of horizontally layered systems is presented as a useful

tool for one-dimensional, large strain, seismic response studies of soil deposits. The program uses a lumped-mass discretization approach and the step-by-step integration procedure, and treats the response of the layered system as piece-wise linear. The program is capable of considering a broad class of specified stress-strain relationships through the multi-linear approximation. Organizational features and various options of the program are described. The use of the program is illustrated. FORTRAN listing and sample input/output are also included. GRA

N76-30748# Missouri Univ., Rolla. Dept of Geophysics.
THE DETECTION AND MAPPING OF SUBTERRANEAN WATER BEARING CHANNELS, PHASE 2 Final Report, Jul. 1972 - Jun. 1974
Richard D. Rechtien, Larry W. Gardner, Marion Sanders, and Randall Tucker 1 Jun. 1975 52 p refs
(Contract DI-14-31-0001-3909; OWRT Proj. B-087-MO(1))
(PB-250459/5; W76-05129) Avail: NTIS HC $4.50 CSCL 08H

Field experiments were conducted over a near-surface cavern to obtain a spatial definition of the associated Cavity Resonance Phenomenon. A data system consisting of a mobile laboratory housing a minicomputer, its peripherals, and associated test equipment, was assembled to record three-component ground velocity measurements. A very accurate subsurface survey was made of one passage approximately 162 feet below the surface with a uniform shape, a height of about 100 feet, and a width of 51 feet. Strong reflection was obtained from an unexplored arm of one cave. Test drilling showed this to be a mud-filled cavern. GRA

N76-30749# California Inst. of Tech., Pasadena. Seismological Lab.
NEAR FIELD SMALL EARTHQUAKE LONG PERIOD ARRAY Final Report, 1 Jun. 1972 - 30 Nov. 1975
Charles B. Archambeau and Donald V. Helmberger 1976 72 p refs
(Contract F44620-72-C-0083; ARPA Order 2134)
(AD-A023144; AFOSR-76-0337TR) Avail: NTIS CSCL 17/10

This final report describes the accomplishments acheived during the last year efforts towards a better understanding of the seismic radiation from earthquakes. Applying the techniques discussed in earlier reports on calculating the synthetic response generated by shear dislocation sources in a layered media, an effort has been made to separate source effects from those due to propagation in the earth. The main objective here is an accurate scaling law of duration versus moment to be used in discrimination studies. The observations used in this report are of two types, those that are large enough to be studied teleseismically where one must separate the phases P, sub pP and sub sP etc, and those that are too small to be observed at large distances and must be studied locally. Thus the efforts have been divided into two sections, to model local broadband observations of moderate size earthquakes, and secondly, to apply recently developed generalized inversion theory to the problem of obtaining source determinations based on teleseismic long and short period body waves. GRA

N76-30750# Lockheed Missiles and Space Co., Palo Alto, Calif.
SUMMARY OF INSTITUTE PROCEEDINGS, MAGNETOSPHERIC PARTICLES AND FIELDS Final Report, Oct. 1974 - Sep. 1975
Billy M. McCormac Sep. 1975 31 p Held at Graz, Austria, 4-15 Aug. 1975 Sponsored in part by ONR
(Contract DNA001-75-C-0084; DNA Proj. NWED-QAXHD028) (AD-A022849; LMSC-D462084; DNA-3783F) Avail: NTIS HC $4.00 CSCL 03B

The presentations and discussions of the Summer Advanced Study Institute, 'Magnetospheric Particles and Fields' held at Graz, Austria, August 4-15, 1975, are summarized. Topics included are: Bow Shock and Magnetosheath; Outer Magnetosphere -- Magnetopause, Boundary layers, and Plasma reservoirs; Plasma Processes in the Inner Magnetosphere -- Particles, Heavy ions and Waves; Ionosphere-Magnetosphere Interactions; and Planetary Magnetospheres -- Jupiter, Mercury and Mars. GRA

N76-30751# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
STRAIN EFFECT ON THE STRENGTH OF FROZEN SILT
F. D. Haynes, J. A. Karalius, and J. Kalafut Dec. 1975 31 p refs
(DA Proj. 4A7-62719-AT-30)
(AD-A021981; CRREL-RR-350) Avail: NTIS CSCL 08/12

Uniaxial compression and tension tests were conducted on frozen Fairbanks silt at a temperature of -10 C. A relatively stiff testing machine was operated at a constant displacement rate for each test. The tests showed that compressive strength is very sensitive to strain rate and the tensile strength is relatively insensitive to it. The compressive strength increased ten times over a srain rate range of .00012/S to 2.9/s. As was found in other investigations, tangent moduli increased slightly with greater strain rates. The specific energy increased at higher strain rates for compression tests and decreased slightly for tension tests. For increased strain rates, uniaxial compression strength showed no tendency to plateau, nor did the specific energy a minimum during uniaxial tensile testing. Author (GRA)

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N76-30752 Wisconsin Univ., Madison.
VARIATIONS IN GENERAL CIRCULATION AND CLIMATE OVER THE TROPICAL ATLANTIC AND AFRICA: WEATHER ANOMALIES IN THE SUBSAHARAN REGION Ph.D. Thesis
Peter James Lamb 13 Sep. 1976 126 p
Avail: Univ. Microfilms Order No. 76-15996

The large scale patterns of atmospheric circulation and other indicative meteorological and oceanographic parameters associated with weather anomalies affecting Subsaharan West Africa (11-20 N) are identified. Sixty-two years 1911-72) of ships' surface observations for the tropical Atlantic (30 N-30S), in the form of individual monthly (e.g., June 1947) averages of 17 elements of one degree squares, constitute the main source of data. A 60-year (1911-70) mean climatology is constructed as a background reference for the subsequent study of patterns for anomalous years. The Subsaharan zone experienced drought conditions in years around 1913, 1921, and 1926, during the 1940's, and between 1968-74. Abundant rainfall occurred during the 1950's. Dissert. Abstr.

N76-30753 Arizona Univ., Tucson.
A ZONALLY AVERAGED MERIDIONAL-PLANE NUMERICAL MODEL OF THE GLOBAL CLIMATIC PATTERN Ph.D. Thesis
David Lee Newquist 1976 175 p
Avail: Univ. Microfilms Order No. 76-18257

A zonally-averaged global climate model was developed. The atmosphere is divided into boxes in the meridional plane which are bounded by specified latitudes and altitudes. There are twenty-four latitude intervals. In the vertical, variable values are calculated for the surface, the 1-km planetary boundary layer, nine 3-km layers aloft, and the atmosphere above the top layer. The model variables are climatic average quantities, defining an annual cycle which is intended to compare with an average of many observed annual cycles. The equations are formulated in terms of mass-weighted average quantities in the boxes and transports across the box boundaries. The distinguishing feature of the model is the lack of constraint on the vertical structure of the wind and temperature fields. The basic equations of the model are the laws of conservation of energy, mass, and momentum. These equations determine the values of the temperature, pressure, and wind velocity. Dissert. Abstr.

N76-30754 Columbia Univ., New York.
NUMERICAL EXPERIMENTS ON LONG-RANGE WEATHER PREDICTION Ph.D. Thesis
Abraham Neil Seidman 1976 224 p
Avail: Univ. Microfilms Order No. 76-18480

A method was investigated for increasing the length of prediction time for intermediate-range forecasting (7 to 30 days).

The ensemble average of a set of forecasts generated by random perturbations from an observed initial state is used. The method was investigated by means of a simulation study utilizing a 3-layer general circulation model. It was found that the technique of ensemble averaging can lead to an increased predictability time when compared either to a single forecast made from the observed state, or to climatological means. Dissert. Abstr.

N76-30755 Washington Univ., Seattle.
THE ROLE OF CONVECTIVE-SCALE PRECIPITATION DOWNDRAFTS IN CUMULUS-SYNOPTIC-SCALE INTERACTIONS Ph.D. Thesis
Richard Harlan Johnson 1975 147 p
Avail: Univ. Microfilms Order No. 76-17520

A diagnostic model was developed to determine the contribution by convective-scale precipitation downdrafts to the total cumulus fluxes of mass, heat and moisture on the synoptic scale. Cumulus downdrafts as well as updrafts are modeled as simple, one-dimensional entraining plumes or jets. By considering a population of clouds that have tops reaching to various heights in the troposphere, each with a unique rate of mass entrainment and each possessing an adjacent downdraft, the sensible and latent heat transports due to cumulus clouds containing both updrafts and downdrafts are determined. An integral equation for a function representing the cloud base mass flux for each type of cloud is derived based on an assumption regarding the relative intensities of the updraft and downdraft. The model was tested on data from a tropical wave disturbance in the western Pacific and a heavy rain-producing tropical depression that occurred over northern Florida. Dissert. Abstr.

N76-30756# National Weather Service, Silver Spring, Md.
SHORT RANGE THUNDERSTORM FORECASTING FOR AVIATION Interim Report, 1 Jul. 1974 - 31 Aug. 1975
M. A. Alaka, Jerome P. Charba, and Robert C. Elvander Nov. 1975 27 p refs
(Contract DOT-FA74WAI-488)
(AD-A025958/0; FAA-RD-75-220) Avail: NTIS HC$4.00 CSCL 04/2

The approach used and results achieved in efforts to develop short range (0-6 hr) thunderstorm forecasts for aviation are described. For the 0-2 hr forecasts, the main source of information is digitized radar data. We have made 10-, 30-, and 60-minute forecasts of thundery activity by tracking and extrapolating radar echo movement, as revealed from sequences of digitized zero degree reflectivities 10 and 30 minutes apart. We have used three different tracking models of varying degrees of sophistication, were used and results were compared. Experimental forecasts of patterns of vertically integrated liquid water known to be associated with thunderstorms were made. In the 2-6 hr range, a combination of classical and model output statistics were used to predict the occurrence of thunderstorms from relevant observations and forecasts made at an earlier time. These consist of observations of manually digitized radar, hourly surface observations of wind, temperature, humidity, and pressure, and predicted 500 mb temperatures. Author

N76-30757*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASA GLOBAL ATMOSPHERIC SAMPLING PROGRAM (GASP) DATA REPORT FOR TAPE VL0002
James D. Holdeman and Erwin A. Lezberg Aug. 1976 36 p refs
(NASA-TM-X-73484; E-8868) Avail: NTIS HC $4.00 CSCL 04B

The NASA Global Atmospheric Sampling Program (GASP) is now obtaining measurements of atmospheric trace constituents in the upper troposphere and lower stratosphere using fully automated air sampling systems on board several commercial 747 aircraft in routine airline service. Atmospheric ozone, water vapor, and related flight and meteorological data for March to October 1975, obtained during 159 flights of a United Airlines 747, are now available as GASP tape. In addition to the GASP data, tropopause pressure fields obtained from NMC archives for the dates of the GASP flights are included on the data tape. Flight routes and dates, instrumentation, data processing procedures, and data tape specifications are described in this report. Author

N76-30758*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TORNADOES AND OTHER ATMOSPHERIC VORTICES
Robert G. Deissler 1976 39 p refs Presented at Natl. Heat Transfer Conf., St. Louis, Missouri, 9-11 Aug. 1976; sponsored by the Am. Soc. of Mech. Engr. and the Am. Inst. of Chem. Engr.
(NASA-TM-X-73466; E-8813) Avail: NTIS HC $4.00 CSCL 04B

The growth of random vortices in an atmosphere with buoyant instability and vertical wind shear is studied along with the velocities in a single gravity-driven vortex; a frictionless adiabatic model which is supported by laboratory experiments is first considered. The effects of axial drag, heat transfer, and precipitation-induced downdrafts are then calculated. Heat transfer and axial drag tend to have stabilizing effects; they reduce the downdrafts of updrafts due to buoyancy. It is found that downdrafts or tornadic magnitude might occur in negatively-buoyant columns. The radial-inflow velocity required to maintain a given maximum tangential velocity in a tornado is determined by using a turbulent vortex model. Conditions under which radial-inflow velocities become sufficiently large to produce tangential velocities of tornadic magnitude are determined. The radial velocities in the outer regions, as well as the tangential velocities in the inner regions may be large enough to cause damage. The surface boundary layer, which is a region where large radial inflows can occur, is studied, and the thickness of the radial-inflow friction layer is estimated. A tornado model which involves a rotating parent cloud, as well as buoyancy and precipitation effects, is discussed. Author

N76-30759# Institut Royal Meteorologique de Belgique, Brussels.
ATMOSPHERIC HUMIDITY IN BELGIUM. PART 1: INTRODUCTION AND EXPLANATORY TEXT REGARDING PARTS 2 AND 8 [L'HUMIDITE DE L'AIR EN BELGIQUE. FASCICULE 1: INTRODUCTION ET TEXTE EXPLICATIF DES FASCICULES 2 ET 8]
A. Bodeux 1975 12 p In FRENCH and DUTCH 8 Vol.
(Misc-Ser-B-30-Pt-1) Avail: NTIS HC $3.50

Volumes 2 to 8, concerning air humidity observations from various synoptic stations in Belgium, are introduced. Tables containing daily, monthly, and annual variations of values of the atmospheric humidity parameters including water vapor pressure, absolute humidity, relative humidity, mixing ratio, water vapor saturation deficit, dew point temperature, and frequency of simultaneous air temperature and relative humidity values are presented in the corresponding volumes. The synoptic stations as well as the period of observations are listed. ESA

N76-30760# Institut Royal Meteorologique de Belgique, Brussels.
ATMOSPHERIC HUMIDITY IN BELGIUM. PART 2: WATER VAPOR PRESSURE [L'HUMIDITE DE L'AIR EN BELGIQUE. FASCICULE 2: LA TENSION DE VAPEUR D'EAU]
A. Bodeux 1975 66 p In FRENCH and DUTCH 8 Vol.
(Misc-Ser-B-31-Pt-2) Avail: NTIS HC $4.50

The water vapor pressure hourly and daily variations are tabulated for various synoptic stations in Belgium. Daily distributions are given at 3 hr intervals. The normalized water vapor pressure per month is given with the same interval together with possible error and standard deviation. The variations of the monthly normalized values with respect to the Uccle station are given together with absolute extremes. ESA

N76-30761# Institut Royal Meteorologique de Belgique, Brussels.
ATMOSPHERIC HUMIDITY IN BELGIUM. PART 3: ABSOLUTE HUMIDITY [L'HUMIDITE DE L'AIR EN BELGIQUE. FASCICULE 3: L'HUMIDITE ABSOLUE]
A. Bodeux 1975 66 p In FRENCH and DUTCH 8 Vol.
(Misc-Ser-B-32-Pt-3) Avail: NTIS HC $4.50

The variations of absolute humidity (ratio of water vapor mass to air volume) expressed in Mg/cu m are tabulated for various synoptic stations in Belgium. Daily distributions are given at 3 hr intervals. The normalized absolute humidity per month is given with the same interval together with possible error and standard deviations. The variations of the monthly normalized values with respect to the Uccle station are given together with absolute extremes. ESA

N76-30762# Institut Royal Meteorologique de Belgique, Brussels.
ATMOSPHERIC HUMIDITY IN BELGIUM. PART 4: RELATIVE HUMIDITY [L'HUMIDITE DE L'AIR EN BELGIQUE. FASCICULE 4: L'HUMIDITE RELATIVE]
A. Bodeux 1975 68 p In FRENCH and DUTCH 8 Vol.
(Misc-Ser-B-33-Pt-4) Avail: NTIS HC $4.50

The variations of relative humidity (ratio of water vapor pressure to corresponding air maximum pressure) expressed in percentage are tabulated for various synoptic stations in Belgium. Daily distributions are given at 3 hr intervals. The normalized relative humidity per month is given with the same interval together with possible error and standard deviations. The variations of the monthly normalized values with respect to the Uccle stations are given. The normalized total annual duration of the relative humidity between 1 and 10, 11 and 20,.... 81 and 90, 91 and 100 % are given. The absolute extremes (minima only) at synoptic hours are tabulated. ESA

N76-30763# Institut Royal Meteorologique de Belgique, Brussels.
ATMOSPHERIC HUMIDITY IN BELGIUM. PART 6: AIR SATURATION DEFICIT IN WATER VAPOR [L'HUMIDITE DE L'AIR EN BELGIQUE. FASCICULE 6: LE DEFICIT DE SATURATION DE L'AIR EN VAPEUR D'EAU]
A. Bodeux 1975 66 p In FRENCH and DUTCH 8 Vol.
(Misc-Ser-B-35-Pt-6) Avail: NTIS HC $4.50

The variations of water vapor saturation deficit of the air are tabulated for various synoptic stations in Belgium. The daily distributions are given at 3 hr intervals. The normalized value per month is given with the same interval together with possible error and standard deviations. The variations of the monthly normalized values with respect to the Uccle station are given together with absolute extremes. ESA

N76-30764# Institut Royal Meteorologique de Belgique, Brussels.
ATMOSPHERIC HUMIDITY IN BELGIUM. PART 7: DEW POINT TEMPERATURE [L'HUMIDITE DE L'AIR EN BELGIQUE. FASCICULE 7: LA TEMPERATURE DU POINT DE ROSEE]
A. Bodeux 1975 66 p In FRENCH and DUTCH 8 Vol.
(Misc-Ser-B-36-Pt-7) Avail: NTIS HC $4.50

The variations of dew point temperature are tabulated for various synoptic stations in Belgium. The daily distributions are given at 3 hr intervals. The normalized value per month is given with the same interval together with possible error and standard deviations. The variations of the monthly normalized values with respect to the Uccle station are given together with extreme values. ESA

N76-30765# Institut Royal Meteorologique de Belgique, Brussels.
ATMOSPHERIC HUMIDITY IN BELGIUM. PART 8: SIMULTANEOUS VALUES OF AIR TEMPERATURE AND HUMIDITY [L'HUMIDITE DE L'AIR EN BELGIQUE. FASCICULE 8: LES VALEURS SIMULTANEES DE LA TEMPERATURE ET DE L'HUMIDITE DE L'AIR]
A. Bodeux 1975 107 p In FRENCH and DUTCH 8 Vol.
(Misc-Ser-B-37-Pt-8) Avail: NTIS HC $5.50

The normalized frequency per month in 0/00 of simultaneous values of temperature and relative humidity are tabulated for various synoptic stations in Belgium. These normalized frequencies are deduced from observations at 3 hr intervals.ESA

N76-30766# World Meteorological Organization, Geneva (Switzerland).
GUIDE ON THE GLOBAL DATA-PROCESSING SYSTEM. VOLUME 1: ORGANIZATION, PRACTICES AND PROCEDURES OF THE GLOBAL DATAPROCESSING SYSTEM
1976 189 p refs
(WMO-305-Vol-1) Avail: NTIS HC $7.50; WMO, Geneva Sw. Fr. 12

The guide is intended to supplement the basic decisions of WMC and the description of practices, procedures, and specifications concerning the GDPS. Following a description of the location and real time functions of the various types of meteorological centers, a description is given of numerical and manual methods used in real time analysis and prognosis. The non-real time functions of the centers are discussed together with the time of availability of WMO and RMC processed products. Priorities for the transmission of data and products are indicated. ESA

N76-30767# Stockholm Univ. (Sweden). Inst. of Meteorology.
[RESEARCH ACTIVITIES OF THE INTERNATIONAL METEOROLOGICAL INSTITUTE] Annual Report, Jul. 1974 - Jun. 1975
Dec. 1975 27 p refs
(AR-74-75) Avail: NTIS HC $4.00

Research activities in dynamical meteorology, atmospheric chemistry, atmospheric physics and geophysical fluid mechanics for the year 1974/75 are presented. Lists of visiting scientists and publications are given together with a financial statement ESA

N76-30768# Environmental Research and Technology, Inc., Concord, Mass.
ENVIRONMENTAL DEFINITION PROGRAM CROSS SECTIONAL ANALYSIS SUMMARY OF DATA AND ANALYSIS TECHNIQUES Final Report, 1 Oct. 1973 - 31 Dec. 1975
Anthony S. Lisa, Pieter J. Feteris, and Allan J. Bussey 31 Dec. 1975 41 p refs
(Contract F19628-74-C-0073; AF Proj. 627A)
(AD-A021908; AFCRL-TR-76-0002) Avail: NTIS CSCL 04/2

A unique set of data was compiled and analyses were prepared in support of the Environmental Definition Program (EDP) effort. This data set formed the basic input to the AFCRL second generation model (AFCRL II) which was used to derive a climatology of liquid water content profiles and hydrometeor distribution at selected U.S. and Eurasian locations. The data set consists of conventional and meteorological data (surface and upper air): DMSP satellite imagery; Air Force Global Weather Central's three-dimensional nephanalyses; time-height cross section analyses of temperature, moisture, stability fields; inferred cloud and hydrometeor fields; and cloud nephanalyses based on the DMSP imagery. Approximately 4000 time-height cross sections and 1450 satellite nephanalyses were prepared for the period between 1 February 1973 and 30 January 1974. This report describes the technique used for the preparation of these analyses. GRA

N76-30769# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
APPLICATION OF SATELLITE CLOUD-MOTION VECTORS TO HURRICANE TRACK PREDICTION
Alan L. Adams and Frederick Sanders Dec. 1975 59 p refs
(Contract F19628-75-C-0059; AF Proj. 6698)
(AD-A021907; SR-1; AFCRL-TR-75-0635) Avail: NTIS CSCL 04/2

The representation of the mean tropospheric flow by satellite-derived cloud-motion vectors is studied for use in a barotropic hurricane prediction model. The systematic use of these vectors is considered over areas not covered by rawinsonde data to aid the initial analysis of the flow pattern. Linear regression analysis is used to develop equations for the pressure-averaged tropospheric flow from data at only 1, 2, or 3 levels. The equations are derived from a large sample of rawinsonde observations, used as simulated cloud-motion vectors, from the tropical and subtropical latitudes of the Northern Hemisphere. The performance of the regression equations on independent data is considered, as is the loss of skill when satellite winds are used in the equations instead of rawinsonde winds. The satellite data is applied, in a pilot study, to two operational SANBAR hurricane forecasts, with inconclusive results. Author (GRA)

N76-30770# National Science Foundation, Washington, D.C. Office for the International Decade of Ocean Exploration.
COASTAL UPWELLING ECOSYSTEMS ANALYSIS, CUE-1 METEOROLOGICAL ATLAS, VOLUME 2
R. D. Pillsbury, James J. OBrien, and Andrew Johnson, Jr. Sep. 1974 196 p
(Contract NSF GX-28746)
(PB-251522/9; NSF/IDOE-75-97-Vol-2) Avail: NTIS HC $7.50 CSCL 04B

The second of two meteorological atlases prepared from data collected in CUE-1 off Oregon during the summer of 1972 is presented. This volume contains the surface streamline analysis on a microscale chart for July and August, time series analysis of buoy gathered winds, and ATS-1 photographs. Mesoscale

streamlines for the CUE-1 area were analyzed for August 1972 at 6-hour intervals. Also included are three hourly analyses for the period, 23-25 August, during which time additional sea breeze observations were made. GRA

N76-30771# RAND Corp., Santa Monica, Calif.
CLIMATIC CHANGE
W. Lawrence Gates and John Imbrie (Brown Univ.) May 1975 45 p refs Presented at the 16th General Assembly of the Intern. Union of Geodesy and Geophysics, Grenoble, France, 25 Aug. - 6 Sep. 1975
(AD-A021703; P-5437) Avail: NTIS CSCL 04/2

During the past four years interest in the problem of climatic change has greatly increased, due in part to growing recognition of its impact on human affairs. This has been matched by a surge of scientific research on nearly all aspects of the problem, especially the areas of climatic data analysis and climatic modeling for both present and past climates. During this period the large-scale distribution of global climate was successfully simulated by a variety of numerical models, and extensive efforts are underway to further improve their accuracy. Climate models have also been used in new diagnoses of the mechanisms of both past and possible future climatic changes, an activity which has underscored the need for more complete documentation of both recent instrumentally observed climatic changes and of those inferred from historical and paleoclimatic sources. GRA

N76-30772# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
OPTIMAL WIND VELOCITY ESTIMATION
Fredrick J. Taylor, Thomas H. Pries, and Chao-Huan Huang Ft. Monmouth, N. J. ECOM Dec. 1975 30 p refs
(AD-A022055; ECOM-5581) Avail: NTIS CSCL 04/2

A new approach to remote wind velocity sensing is proposed, developed, and tested. Wind estimates were obtained from the spectral signature of an optical signal source. The signal was derived from the random scattering of a laser beam in the lower atmosphere. A quasi-supervised learning machine, using a minimal variance linear estimator, was used to produce the wind velocity estimate. New stopping rules, used to guarantee the convergence of the learning process, were also developed. Field experimentation indicates that the new system will perform well; even under extreme optical nonlinear conditions (severe turbulence). GRA

N76-30773# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
AN EMPIRICAL METHOD OF FORECASTING THUNDERSTORMS FOR THE WHITE SANDS MISSILE RANGE
David J. Novlan Ft. Monmouth, N. J. ECOM Feb. 1976 14 p refs
(DA Proj. 1T7-65702-D-127)
(AD-A022046; ECOM-5584) Avail: NTIS CSCL 04/2

An empirical method for forecasting the occurrence of thunderstorms at White Sands Missile Range has been developed and tested during 1974 and 1975. The theoretical foundation and the actual application of the method are presented in this report. This forecast aid is easily adaptable to operational forecasting. The method can also be computerized if desired. Inputs of moisture and instability are used to arrive at a probability for the occurrence of a thunderstorm. The procedure behind this forecast method is believed to be universally applicable to forecasting thunderstorms at other locations in arriving at analogous probability categories. GRA

N76-30774# RAND Corp., Santa Monica, Calif.
COMPUTATIONS WITH THE RAND CLOUD MODEL FOR THE HIPLEX WORKSHOP, JUNE 1975
F. W. Murray Jul. 1975 40 p ref
(AD-A022268; P-5473) Avail: NTIS CSCL 04/2

The High Plains Cooperative Experiment sponsored by the Division of Atmospheric Water Resource Management of the Bureau of Reclamation is a large-scale project to study the feasibility of augmenting precipitation in the High Plains region by artificial means. In July 1974 a planning workshop was held in Vail, Colorado, at which intensive studies of the requirements for cloud modeling, measurements, and design and evaluation were made. One recommendation that came from the modeling sessions was that of the models developed by the various participants be tested with the same set of data, and that another workshop be convened to compare the results. This was done, and the modeling workshop was held in Denver on 11-13 June 1975. Approximately 14 participants presented results of their models. Data for two days, 10 and 17 August 1973, for the St. Louis region from Project METROMEX were provided. The remainder of the workshop was devoted to working up recommendations for observations to be made during the high Plains Experiment both for initialization and verification of the model. GRA

N76-30775# RAND Corp., Santa Monica, Calif.
NUMERICAL MODELING OF CLIMATIC CHANGE: A REVIEW OF PROBLEMS AND PROSPECTS
W. Lawrence Gates Jul. 1975 27 p refs Presented at the WMO/IAMAP Symp. on Long-Term Climatic Fluctuations, Norwich, England, 18-23 Aug. 1975
(AD-A022266; P-5471) Avail: NTIS CSCL 04/2

The atmospheric, oceanic and cryospheric elements of the global climatic system are briefly considered, and along with the principal characteristics of climatic change. The development of numerical general circulation models of statistical-dynamical models is reviewed from the point of view of their inherent limitations for the simulation of climatic change. The performance of selected atmospheric models is summarized in terms of their simulation of the zonally-averaged January sea-level pressure and precipitation rate; the differences among the models: results are large, particularly in the lower latitudes, and the model's errors compared with observation bear no clear relationship to the number of models levels. The further improvement of such models appears to rest with the introduction of more adequate parameterizations for convection and the surface boundary layer, and perhaps most importantly for climatic simulations, with the coupling of interactive models of the ocean, ice sheets and land surface character. The future of climate modeling is seen to involve the use of a hierarchy of models of various degrees of resolution. Special attention must be given to the trade-offs between the conventional global circulation models and a variety of statistical-dynamical models. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N76-30776 Denver Univ., Colo.
INTERNAL GRAVITY WAVE PROPAGATION THROUGH A SHARP THERMOCLINE Ph.D. Thesis
Edmon L. Adams 1976 108 p
Avail: Univ. Microfilms Order No. 76-17867

The model studied is described by a linearization of the fluid equations brought about by assuming that the internal waves are small amplitude perturbations on a prescribed inviscid incompressible ambient state. The thermocline is modeled by an interface problem where a jump discontinuity exists in an otherwise constant Brunt-Vaisala frequency. An exact integral representation is obtained for the solution via Fourier transforms and elimination. Integrals representing incident, reflected and transmitted waves are then approximated using multi-dimensional stationary phase and steepest descent. The phenomena of transition radiation along with lateral wave propagation from the interface back to the region of disturbance are also studied. Transition radiation is found but no lateral wave. Two particular examples are investigated, a source moving with a vertical trajectory and an oscillating stationary source. For this later source a new interpretation of some experimental results is offered. Dissert. Abstr.

N76-30777# National Center for Atmospheric Research, Boulder, Colo.
A NUMERICAL STUDY OF MID-OCEAN MESOSCALE EDDIES Ph.D. Thesis - Johns Hopkins Univ.
William Brechner Owens Dec. 1975 119 p refs
(Contract NSF C-760)
(PB-252371/0; NCAR-CT-36) Avail: NTIS HC $5.50 CSCL 08C

Using a limited-area, numerical model statistics describing the structure of mid-ocean, mesoscale eddies were simulated and compared with the MODE observations. These statistics included various time spectra, velocity covariances, and dynamic thickness structure functions. The only appreciable deficiencies of the simulation are that it underpredicts the eddy energy at small scales, it is too barotropic, and that it underpredicts the eddy decay time. It successfully predicts the length and time scales and westward propagation speed of the eddies. From these studies it is apparent that limited-area numerical models could be used to simulate mesoscale eddies both for planning future experiments and for futher studying the dynamics of mesoscale eddies. GRA

N76-30778# Michigan Univ., Ann Arbor.
COMPUTER SIMULATION IN THE ANALYSIS OF SURFACE CURRENT DRIFTER DATA
Philip Charles Pilgrim Oct. 1975 307 p refs Sponsored in part by the Chicago City Dept. of Development and Planning and the Michigan Sea Grant Program
(Grants NOAA-04-5-158-16; NSF DCR-71-01997)
(PB-252374/4; LCG-TR-189; MICHU-SG-75-204; NOAA-76022505-TR-46) Avail: NTIS HC $9.75 CSCL 08C

Drifter data are analyzed on two fronts: hypothesis testing and hypothesis generation. In hypothesis testing, various conjectured current patterns are used in a simulation of the advective and diffusive processes transporting the drifters, and the results of each are compared with the actual data in order to select the hypothesis most compatible with the data. In addition, locations in the investigated water body can be selected to yield data optimally distinguishing among the available hypotheses, assuming that one is true. GRA

N76-30779# National Center for Atmospheric Research, Boulder, Colo.
ESTIMATION OF SPATIAL COVARIANCES FROM THE MID-OCEAN DYNAMICS EXPERIMENT
J. C. McWilliams and W. B. Owens Feb. 1976 33 p refs
(Contract NSF C-760)
(PB-252355/3; NCAR/TN-115) Avail: NTIS HC $4.00 CSCL 08C

Mesoscale ocean eddies were observed in the western North Atlantic, primarily during the spring of 1973. A variety of measurement techniques were used. Using data from freely drifting Sofar floats and from hydrographic casts, the spatial covariance functions and the associated variance spectra were estimated. Azimuthal averages of the smoothed functions yielded estimates of isotropic covariances. Analytical functional forms were fitted to the isotropic covariances for subsequent use in objective analyses. GRA

N76-30780# National Oceanographic Instrumentation Center, Washington, D.C.
INDEX TO NATIONAL OCEANOGRAPHIC INSTRUMENTATION CENTER PUBLICATIONS Instrument Fact Sheet, 1958 - 1976
Jan. 1976 17 p refs
(PB-252550/9; IFS-76004; NOAA-76022503) Avail: NTIS HC $3.50 CSCL 08C

The index is issued as a service for recipients of publications issued by the National Oceanographic Instrumentation Center, Washington, D.C. The index is divided into three major sections: Instrument Fact Sheets, Technical Bulletins, and Technical Memorandums. GRA

N76-30781# Center for Naval Analyses, Arlington, Va. Warfare Analysis Group.
MODELING THE OCEAN: INTRODUCTION TO WAVE PROPAGATION IN A TURBULENT MEDIUM
Alfred Kaufman Jan. 1976 61 p
(Contract N00014-76-C-0001)
(AD-A023041; CRC-293) Avail: NTIS CSCL 20/14

The observation fundamental to this work is that the ocean is usually in a state of turbulent motion. Correspondingly, the value of the temperature at every point in the ocean undergoes irregular fluctuations. In particular, since the index of refraction of the ocean is a function of temperature, we shall take the viewpoint that the refractive index is random and assume that the Kolmogorov theory of locally homogeneous and isotropic turbulence provides a sufficiently good description of the refractive index microstructure. To extract information concerning the randomness of an acoustic wave propagating through this turbulent and unbounded ocean, we make use of the wave equation to connect the statistical properties of the random medium to the impiled statistical properties of the wave parameters within the framework of a correlation theory. We accomplish this only to first order in perturbation theory, thus restricting the realm of validity of our results to high frequencies and small refractive index fluctations. The structure function of the logarithmic amplitude we find, generalizes similar results of Tatarski and Chernov away from the transversal, correspondingly longitudinal restrictions inherent in their work. Author (GRA)

N76-30782# Coastal Engineering Research Center, Fort Belvoir, Va.
WAVE RUNUP ON A 1 ON 10 SLOPE
John Ahrens Dec. 1975 28 p refs
(AD-A021577; CERC-MP-12-75) Avail: NTIS CSCL 08/3

This study was directed towards comparing the runup caused by monochromatic and simple irregular waves on a smooth 1 on 10 slope. Wave runup was measured by use of a modified step-resistance wave gage which gave reliable measurements of extreme values and also provided a complete time history of the runup-air interface on the slope. Irregular waves caused considerably higher extreme values of runup than monochromatic waves even when runup was normalized by dividing by the standard deviation of the incident wave water surface displacement. The research is of a preliminary nature, and the findings are being used to develop a comprehensive wave runup and overtopping study to be conducted at CERC's new facilities at Fort Belvoir, Virginia. GRA

N76-30783# RAND Corp., Santa Monica, Calif.
DIAGNOSTIC MODEL STUDY OF MIXED LAYERS DEPTHS IN THE SUMMER NORTH PACIFIC
R. C. Alexander and Jeong-Woo Kim Aug. 1975 28 p refs
(Contract DAHC15-73-C-0181)
(AD-A021708; P-5478) Avail: NTIS CSCL 12/1

The Kraus-Turner one-dimensional diagnostic model for calculating oceanic mixed layer depths gives realistic results for the entire summer North Pacific provided the effect of dissipation is appropriately included to limit mixed layer depths, particularly in regions where heating is weak. Author (GRA)

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N76-30784*# Rice Univ., Houston, Tex. Dept. of Environmental Science and Engineering.
PHOTOSYNTHETIC AND RESPIRATORY ACTIVITY IN GERMFREE HIGHER PLANT SPECIES Final Report
Jul. 1976 11 p
(Contract NAS9-12912)
(NASA-CR-147855) Avail: NTIS HC $3.50 CSCL 06C

Equipment developed for the study of gas exchange in germfree plants is described. The equipment includes a gas exchange chamber to house the plant under study, a gas feed assembly to introduce and remove gas from the chamber, and a clinostat to rotate the apparatus. Fluorescent and incandescent lights are used to illuminate the chamber and a sealed plastic barrier is used to isolate the potting soil from the chamber atmosphere. The gas outflow from the chamber can be diverted to an infrared CO2 analyzer. The performance of the system was evaluated. D.M.L.

N76-30785*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN AUTOMATED SYSTEM FOR CHROMOSOME ANALYSIS. VOLUME 1: GOALS, SYSTEM DESIGN, AND PERFORMANCE Final Report
K. R. Castleman and J. H. Melnyk (City of Hope Medical Center) 30 Jun. 1975 137 p refs Sponsored in part by NIH
(NASA-CR-148741; JPL-1200-240-Vol-1) Avail: NTIS

HC $6.00 CSCL 06B

The design, construction, and testing of a complete system to produce karyotypes and chromosome measurement data from human blood samples, and a basis for statistical analysis of quantitative chromosome measurement data is described. The prototype was assembled, tested, and evaluated on clinical material and thoroughly documented. Author

N76-30786*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN AUTOMATED SYSTEM FOR CHROMOSOME ANALYSIS. VOLUME 2: SYSTEM CONSTRUCTION, PROGRAMMING, OPERATION, AND MAINTENANCE Final Report
K. R. Castleman and J. H. Melnyk (City of Hope Medical Center) 30 Jun. 1975 228 p refs Sponsored in part by NIH
(NASA-CR-148740; JPL-1200-240-Vol-2) Avail: NTIS HC $8.00 CSCL 06B

The operation, programming, construction, and maintenance of an automated chromosome analysis system is described. Author

N76-30787*# California Univ., Berkeley. Environmental Physiology Lab.
RESULTS FROM THE EPL MONKEY-POD EXPERIMENT CONDUCTED AS PART OF THE 1974 NASA/AMES SHUTTLE CVT-2
Donald F. Rahlmann, Arthur M. Kodama, Richard C. Mains, and Nello Pace 10 Jun. 1974 48 p refs
(Grant NGL-05-003-024)
(NASA-CR-148730; EPL-74-1) Avail: NTIS HC $4.00 CSCL 06D

The participation of the Environmental Physiology Laboratory (EPL) in the general purpose laboratory concept verification test 3 is documented. The EPL Monkey-Pod Experiment was designed to incorporate a 10-12 kg, pig tailed monkey, Macaca nemestrina, into the pod and measure the physiological responses of the animal continuously. Four major elements comprise the EPL Monkey-Pod Experiment System: (1) a fiberglass pod containing the instrumented monkey plus feeder and watering devices, (2) an inner console containing the SKYLAB mass spectrometer with its associated valving and electronic controls, sensing, control and monitoring units for lower body negative pressure, feeder activity, waterer activity, temperatures, and gas metabolism calibration, (3) an umbilical complex comprising gas flow lines and electrical cabling between the inner and outer console and (4) an outer console in principle representing the experiment support to be provided from general spacecraft sources. Author

N76-30788*# California Univ., Berkeley. Environmental Physiology Lab.
RESULTS FROM THE EPL MONKEY-POD EXPERIMENT CONDUCTED AS PART OF THE 1974 NASA-AMES CVT/GPL 3
Donald F. Rahlmann, Arthur M. Kodama, Richard C. Mains, and Nello Pace 10 Oct. 1974 55 p refs
(Grant NGL-05-003-024)
(NASA-CR-148736; EPL-74-2) Avail: NTIS HC $4.50 CSCL 06D

For abstract, see preceding accession.

N76-30789*# California Univ., Berkeley. Environmental Physiology Lab.
RESULTS FROM THE EPL MONKEY-POD FLIGHT EXPERIMENTS CONDUCTED ABOARD THE NASA/AMES CV-990, MAY 1976
Donald F. Rahlmann, Arthur M. Kodama, Richard C. Mains, and Nello Pace 30 Jul. 1976 141 p refs
(Grant NGL-05-003-024)
(NASA-CR-148737; EPL-76-1) Avail: NTIS HC $6.00 CSCL 06D

The participation of the Environmental Physiology Laboratory (EPL) in the general purpose laboratory concept verification test 3 is documented. The EPL Monkey-Pod Experiment was designed to incorporate a 10-12 kg, pig tailed monkey, Macaca nemestrina, into the pod and measure the physiological responses of the animal continously. Four major elements comprise the EPL Monkey-Pod Experiment System: (1) a fiberglass pod containing the instrumented monkey plus feeder and watering devices, (2) an inner console containing the SKYLAB mass spectrometer with its associated valving and electronic controls, sensing, control and monitoring units for lower body negative pressure, feeder activity, waterer activity, temperatures, and gas metabolism calibration, (3) an umbilical complex comprising gas flow lines and electrical cabling between the inner and outer console and (4) an outer console in principle representing the experiment support to be provided from general space craft sources. Author

N76-30790# BioTechnology, Inc., Falls Church, Va.
BIOMEDICAL ASPECTS OF AIRCRAFT ESCAPE AND SURVIVAL UNDER COMBAT CONDITIONS Final Report
Martin G. Every and James F. Parker, Jr. Mar. 1976 59 p refs Presented at Ann. Scientific Meeting - Aerospace Med. Assoc., 1976
(Contract N00014-72-C-0101; NR Proj. 105-667)
(AD-A021921) Avail: NTIS CSCL 06/7

Detailed event conditions and, to the extent possible, specific medical injury data now have been collected for Navy aircrewmen who ejected and were recovered, or became Prisoners of War in Southeast Asia. Initial analyses (previously reported) show the combat ejection, and consequently the associated injuries, to be appreciably more severe than encountered during non-combat operations. Additional analyses now have been conducted, primarily with repatriated Navy Prisoners of War, to establish some precise cause and effect injury relationships associated with high speed escape. The effect of escape injuries on subsequent evasion and survival is examined. Special attention is given to the effectiveness of escape, personal protective, and life support equipment. The adequacy of this equipment is evaluated in terms of an individual's injury condition and his success in using such equipment under the arduous conditions of combat escape, survival, rescue and capture. GRA

N76-30791# Battelle Pacific Northwest Labs., Richland, Wash.
EFFECTS OF ELECTRIC FIELDS ON LARGE ANIMALS. A FEASIBILITY STUDY Final Report
Richard D. Phillips, Richard L. Richardson, William T. Kaune, Dennis L. Hjeresen, and James L. Beamer Feb. 1976 165 p refs Sponsored by Electric Power Research Inst.
(PB-251632/6; EPRI/EC-131) Avail: NTIS HC $6.75 CSCL 06S

The project concerned experiments conducted to define the experimental conditions required for the long-term exposure of Hanford Miniature Swine (HMS) to high-strength 60 Hz electric fields and preparation of detailed experimental designs for the long-term exposure of HMS and for screening studies using rodents. Experiments were conducted at Bonneville Power Adm.'s 60 HZ Extra High Voltage (EHV) Laboratory at Ross Electrical Laboratories in Vancouver, WA, using four HMS to determine the maximum field strengths, up to 55 kV/m, which do not cause corona discharge, minishocks or hair stimulation. A description of the exposure facility and experimental procedures is given, the results of the tests are discussed, and experimental designs for proposed future research are described. Author

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N76-30792 Washington Univ., Seattle.
THE EFFECTS OF ELECTROMAGNETIC FIELDS ON THE NERVOUS SYSTEM Ph.D. Thesis
Chung-Kwang Chou 1975 129 p
Avail: Univ. Microfilms Order No. 76-17430

The effects of electromagnetic fields on isolated nerves, ganglia, and muscles were studied in vitro. An S band wave guide exposure system in conjunction with a temperature controlled unit were used to expose the nervous tissues or muscle at a constant temperature. Results showed no effect other than thermal on the characteristics of nerves and muscles exposed to 2450 MHz microwave fields at specific absorption rate of 0.3 - 1500 W/kg for CW and 0.3 - 220 kW/kg peak for pulsed fields. The mechanisms of the microwave auditory effect were

also investigated. Experiments on low frequency noise masking showed that only the high frequency portion of the auditory system is involved in the effect. The 50 kHz cochlear microphonics in guinea pig induced by microwave and laser pulses, as well as bone-conducted acoustic stimuli provided by a piezoelectric crystal, indicated that the microwave auditory effect is accompanied by a mechanical disturbance of the hair cells of the cochlea. The disturbance is probably due to thermal expansion in the head. Dissert. Abstr.

N76-30793* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
VISUAL EXAMINATION APPARATUS Patent
Richard F. Haines, James W. Fitzgerald, and Salvadore A. Rositano, inventors (to NASA) Issued 3 Aug. 1976 10 p Filed 19 Mar. 1974 Supersedes N74-19761 (12 - 11, p 1257) Reissue of US Patent Appl. SN-159857, filed 6 Jul. 1971, US-Patent-3,737,214
(NASA-Case-ARC-10329-2; US-Patent-RE-28,921; US-Patent-Appl-SN-452768; US-Patent-Class-351-23; US-Patent-Class-351-30; US-Patent-Class-351-36; US-Patent-Appl-SN-159857; US-Patent-3,737,214) Avail: US Patent Office CSCL 14B

An automated visual examination apparatus for measuring visual sensitivity and mapping blind spot location including a projection system for displaying to a patient a series of visual stimuli. A response switch enables him to indicate his reaction to the stimuli, and a recording system responsive to both the visual stimuli per se and the patient's response. The recording system thereby provides a correlated permanent record of both stimuli and response from which a substantive and readily apparent visual evaluation can be made.
Official Gazette of the U.S. Patent Office

N76-30794 North Dakota Univ., Grand Forks.
EFFECTS OF LONG TERM HYPERBARIC OXYGEN EXPOSURE ON LUNG TISSUE: AN ULTRASTRUCTURAL EVALUATION Ph.D. Thesis
Brian Kent Ross 1975 133 p
Avail: Univ. Microfilms Order No. 76-18152

Both normal and oxygen toxic lung tissue were examined to determine the surface morphological characteristics of each. Separate groups of rats were exposed to 1 ATA room air and 21 ATA He-O2 with 200 mm Hg pO2 for 84 days. At intervals of 2, 3, 5, 8, 10, and 12 weeks, 8 experimental and 8 control animals were removed. The lungs of 7 animals of each group were analyzed for protein, lipid, and lung water. The lungs of the eighth animal were prepared for light microscopy. Separate groups of adult guinea pigs were exposed to 20 ATA He-O2 with 200, 400, and 600 mm Hg pO2 for 24, 12, and 6 days. Four animals were removed every 4 days in the two 24-day exposure groups, every 2 days in the 12-day exposure group, and every day in the 6-day exposure group. Lungs from 3 of the animals of each group wetre removed, weighed wet, freeze dried, and weighed dry. The lungs of 1 animal in each group of 4 were prepared for scanning electron microscopy.
Dissert. Abstr.

N76-30795 North Dakota Univ., Grand Forks.
CARDIAC OUTPUT AND ITS DISTRIBUTION UNDER HYPERSONIC CONDITIONS Ph.D. Thesis
Lawrence E. Boerboom 1975 78 p
Avail: Univ. Microfilms Order No. 76-18141

The purpose of this investigation was two-fold -- first, to devise techniques for determination of cardiac output and its distribution and other related cardiovascular parameters under hyperbaric conditions; second, to use these techniques to assess cardiovascular function in animals respiring normoxic levels of helium-oxygen (He-O2) at 1.0 and 11.0 ATA. Parameters studied were blood pressure, heart rate, stroke volume, cardiac output, total peripheral resistance, circulation time, distribution of cardiac output, organ blood flow and organ resistance to flow. Tissues studied were heart, lung, liver, spleen, kidney, adrenal, brain, femur, diaphragm, colon, duodenum, fat, muscle and skin. Although there were minor but significant changes in some parameters, these results suggest that He-O2 and pressure do not seriously compromise cardiovascular function. Dissert. Abstr.

N76-30796*# Stanford Univ., Calif. Integrated Circuits Lab.
ULTRASONIC DOPPLER MEASUREMENT OF RENAL ARTERY BLOOD FLOW Annual Report, 1 Sep. 1975 - 31 Jul. 1976
William R. Freund, William L. Beaver, and James D. Meindl Aug. 1976 18 p refs
(Grant NGR-05-020-615)
(NASA-CR-148780; SU-SEL-76-030; TR-4962-3) Avail: NTIS HC $3.50 CSCL 06B

Studies were made of (1) blood flow redistribution during lower body negative pressure (LBNP), (2) the profile of blood flow across the mitral annulus of the heart (both perpendicular and parallel to the commissures), (3) testing and evaluation of a number of pulsed Doppler systems, (4) acute calibration of perivascular Doppler transducers, (5) redesign of the mitral flow transducers to improve reliability and ease of construction, and (6) a frequency offset generator designed for use in distinguishing forward and reverse components of blood flow by producing frequencies above and below the offset frequency. Finally methodology was developed and initial results were obtained from a computer analysis of time-varying Doppler spectra.
Author

N76-30797*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ION BEAM SPUTTER MODIFICATION OF THE SURFACE MORPHOLOGY OF BIOLOGICAL IMPLANTS
A. J. Weigand and B. A. Banks 1976 19 p refs Presented at 23d Natl. Vacuum Symp., Chicago, 21-24 Sep. 1976; sponsored by Am. Vacuum Soc.
(NASA-TM-X-73468; E-8840) Avail: NTIS HC $3.50 CSCL 06B

The surface chemistry and texture of materials used for biological implants may significantly influence their performance and biocompatibility. Recent interest in the microscopic control of implant surface texture has led to the evaluation of ion beam sputtering as a potentially useful surface roughening technique. Ion sources, similar to electron bombardment ion thrusters designed for propulsive applications, are used to roughen the surfaces of various biocompatible alloys or polymer materials. These materials are typically used for dental implants, orthopedic prostheses, vascular prostheses, and artificial heart components. Masking techniques and resulting surface textures are described along with progress concerning evaluation of the biological response to the ion beam sputtered surfaces. Author

N76-30798*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN AUTOMATED SYSTEM FOR CHROMOSOME ANALYSIS Final Report
K. R. Castleman and J. H. Melnyk, (City of Hope Medical Center) 7 Apr. 1976 138 p refs Sponsored in part by NIH
(NASA-CR-148755; JPL-5040-30) Avail: NTIS HC $6.00 CSCL 06D

The design, construction, and testing of a complete system to produce karyotypes and chromosome measurement data from human blood samples, and to provide a basis for statistical analysis of quantitative chromosome measurement data are described.
Author

N76-30799# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
RADIATION EXPOSURE RECORDS MANAGEMENT
H. P. Boiter Dec. 1975 9 p Presented at the 9th Topical Symp. on Operational Health Physics, Denver, Colo., 9-12 Feb. 1976
(Contract AT(07-2)-1)
(DPSPU-75-30-7; Conf-760202-29) Avail: NTIS HC $3.50

Management of individual radiation exposure records begins at employment with the accumulation of data pertinent to the individual and any previous occupational radiation exposure. Appropriate radiation monitoring badges or devices are issued and accountability established. A computer master file is initiated to include the individual's name, payroll number, social security number, birth date, assigned department, and location. From this base, a radiation exposure history is accumulated to include external ionizing radiation exposure to skin and whole body, contributing neutron exposure, contributing tritium exposure, and extremity exposure. It is used also to schedule bioassay sampling

and in-vivo counts and to provide other pertinent information. The file is used as a basis for providing periodic reports to management and monthly exposure summaries to departmental line supervision to assist in planning work so that indidividual annual exposures are kept as low as practical. Author (NSA)

N76-30800# Veterans Administration Hospital, Brooklyn, N. Y. Interface Lab.
IDENTIFICATION OF PROTEINS INTERACTING AT BLOOD OR PLASMA/BIOMATERIAL INTERFACES: RELATION TO PLATELET AND WHITE CELL ADHESION, AND TO CLOTTING Annual Report, Oct. 1974 - Oct. 1975
Leo Vroman and Priscilla C. Munoz Feb. 1976 82 p refs
(Contract PHS-HB-50001)
(PB-251768/8; MRIS-9095-75; NIH/NHLI-Y01-HB-5-0001-01-2) Avail: NTIS HC $5.00 CSCL 06L

Of the many materials tested so far, only tetramethyldisiloxane appeared to adsorb albumin out of normal plasma to some degree. Various carbon-coated materials adsorbed fibrinogen out of plasma without converting it rapidly. The importance of fibrinogen adsorption to subsequent platelet adhesion may have its parallel in the role of globulin adsorption to subsequent granulocyte adhesion. It is found that in whole blood or plasma, these cells adhered and spread only where a hydrophobic (rather than a hydrophilic) material had been pre-exposed to gamma globulins. Since either adsorbed globulin orientation or perhaps selective adsorption of Kallikrein is the cause, it too will be studied. GRA

N76-30801# Naval Submarine Medical Research Lab., Groton, Conn.
CARBON DIOXIDE EFFECTS UNDER CONDITIONS OF RAISED ENVIRONMENTAL PRESSURE Interim Report
K. E. Schaefer 26 Dec. 1974 41 p refs
(AD-A020472; NSMRL-804) Avail: NTIS CSCL 06/9

Exposure to the increased barometric pressure, such as encountered under water, affects the mechanics of respiration and in particular the behavior of respiratory gases. Carbon dioxide plays a major role in the physiology of the high-pressure environment since increased breathing resistance easily leads to carbon dioxide retention, as has frequently been noted in scuba and helmet diving. Pulmonary gas exchange in breathhold diving is influenced by the compression and decompression events, resulting in a reversed carbon dioxide gradient during descent. The alveolar carbon dioxide level can be controlled during ascent from depth by controlling the speed of ascent which is of significance to both breathhold diving and the buoyant ascents of submarine escape. Investigations of pulmonary gas exchange in rest and exercise during exposure to high pressure while breathing helium-oxygen gas mixtures have demonstrated the existence of respiratory limitations and associated CO2 retention when divers are performing heavy work. In shallow habitat air diving using combinations of air and normoxic nitrogen-oxygen breathing mixtures, evidence for the development of slight respiratory acidosis and CO2 retention was obtained. GRA

N76-30802# California Univ., Santa Barbara. Inst. of Environmental Stress.
EFFECTS OF LOW LEVELS OF OZONE AND TEMPERATURE STRESS Annual Report, 1 Jul. 1974 - 30 Jun. 1975
Steven M. Horvath and Lawrence J. Folinsbee Mar. 1976 96 p refs
(Contract EPA-68-02-1723)
(PB-252309/0; EPA-600/1-76-001) Avail: NTIS HC $5.00 CSCL 06T

Cardiopulmonary and metabolic responses of 20 adult males (age 19-29) before, during and after a 2-hour exposure to either filtered air or 0.50 ppm ozone under four ambient conditions (25C, 45% rh; 31C, 85% rh; 35C, 40% rh; 40C, 50% rh) were determined. Exercise at 40% of the individual's V02 max was performed from 60-90 min of exposure. There were no cardiovascular changes due to ozone exposure but heart rate increased and stroke volume decreased with increasing heat stress. Rectal, mean body, and mean skin temperature also increased. There was a decrease in vital capacity and total lung capacity due primarily to a reduction of inspiratory capacity following ozone exposure. GRA

N76-30803# Washington Univ., Seattle. School of Medicine.
ACID BASE CHEMISTRY AND HUMAN BONE Annual Progress Report, 1 Jul. 1974 - 30 Jun. 1975
James M. Burnell 31 Jul. 1975 42 p refs
(Grant AM-32208)
(PB-251395/0; AK-1-3-2208) Avail: NTIS HC $4.00 CSCL 06E

It is postulated that magnesium and calcium compete at the cellular level. Incorporation of excess Mg results in defective mineralization. Supplemental Ca by oral or dialytic route corrects the abnormal mineralization toward normal. Decreasing Mg is under investigation. Experimental data in humans and in rats suggest a common pathway for all hypocalcemic states including uremia. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N76-30804*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PREDICTION OF PASSENGER RIDE QUALITY IN A MULTIFACTOR ENVIRONMENT
Thomas K. Dempsey and Jack D. Leatherwood Sep. 1976 41 p refs Presented at 84th Annual Convention of the Am. Psychological Association, Washington, D.C., 3-7 Sep. 1976
(NASA-TM-X-73945) Avail: NTIS HC $4.00 CSCL 05E

A model being developed, permits the understanding and prediction of passenger discomfort in a multifactor environment with particular emphasis upon combined noise and vibration. The model has general applicability to diverse transportation systems and provides a means of developing ride quality design criteria as well as a diagnostic tool for identifying the vibration and/or noise stimuli causing discomfort. Presented are: (1) a review of the basic theoretical and mathematical computations associated with the model, (2) a discussion of methodological and criteria investigations for both the vertical and roll axes of vibration, (3) a description of within-axis masking of discomfort responses for the vertical axis, thereby allowing prediction of the total discomfort due to any random vertical vibration, (4) a discussion of initial data on between-axis masking, and (5) discussion of a study directed towards extension of the vibration model to the more general case of predicting ride quality in the combined noise and vibration environments. Author

N76-30805*# Martin Marietta Corp., Denver, Colo.
FLIGHT OPERATIONS PAYLOAD TRAINING FOR CREW AND SUPPORT PERSONNEL. TASK 3: INFLIGHT OPERATIONS AND TRAINING FOR PAYLOADS
R. F. Beardslee 1 Jun. 1976 102 p
(Contract NAS9-14676)
(NASA-CR-147837) Avail: NTIS HC $5.50 CSCL 05I

Various degrees of Commander/Pilot involvement in on-orbit operation of payloads are examined. Constraints and limitations resulting from their participation or affecting their ability to participate are identified. Four options, each representing a different set of involvement depths and concepts are analyzed. Options identified are boundaries around extremes in Commander/Pilot payload involvement. Real world choices may fall somewhere in between, but for the purposes of this study the options as represented provide a matrix from which logical and practical decisions can be made about crew participation in payload operations. Author

N76-30806# National Swedish Inst. for Building Research, Stockholm.
A SYSTEM FOR THE DESCRIPTION AND CLASSIFICATION OF MOVEMENT BEHAVIOUR
Gun Hallberg 1975 56 p refs
(PB-251337/2; D12-1975) Avail: NTIS HC $4.50 CSCL 05E

The need for an adequate description of individual characteristics, which are relevant for determining human functional dimensions, has emerged ever more clearly in conjunction with

the studies carried out of fundamental dimensional requirements for the design of rooms, furniture and fittings with regard to human functional dimensions. Certain connections have been found between body dimensions - particularly heights - and certain functional dimensions. The present study is limited to the manner in which movement behavior manifests itself externally since a penetration of the physiological and psychological background would lead far beyond the subject limits. Author (GRA)

N76-30807# General Electric Co., Daytona Beach, Fla. Space Systems Div.
ADVANCED SIMULATION IN UNDERGRADUATE PILOT TRAINING: COMPUTER IMAGE GENERATION Final Report, Feb. 1972 - Sep. 1974
H. Beardsley, W. Bunker, A. Eibeck, J. Juhlin, W. Kelly, J. Page, and L. Shaffer Nov. 1975 271 p
(Contract F33615-72-C-1717; AF Proj. 1192)
(AD-A022251; AFHRL-TR-75-59(5)) Avail: NTIS CSCL 05/9

The Advanced Simulation for Undergraduate Pilot Training (ASUPT) system is an advanced simulation system that will be used in a research program by this laboratory (AFHRL) to investigate the simulator role in future Undergraduate Pilot Training programs. The ASUPT simulates the Air Force's primary jet trainer, the Cessna T-37B aircraft. A Computer Image Generator (CIG) system has been developed to provide for a visual simulation of the terrain and other aircraft for research operations in the T-37B aircraft simulator. This CIG development represents an advancement in image generation technology for visual simulation. This report documents the technical development and capabilities of this ASUPT visual simulation system (and thereby, its related technology area) for dissemination to interested and concerned Air Force and Department of Defense personnel and the scientific community. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N76-30808 North Carolina State Univ., Raleigh.
THE EFFECTS OF PERSPIRATION ON ADSORPTION DYNAMICS OF PROTECTIVE CLOTHING MATERIAL Ph.D. Thesis
Arun Pal Aneja 1975 240 p
Avail: Univ. Microfilms Order No. 76-14312

A protective overgarment material of carbon-impregnated polyurethane foam was studied. The dynamics of carbon tetrachloride vapor adsorption, the effect of perspiration poisoning, and methods to alleviate perspiration poisoning for this material were investigated. A central composite statistical design of experiments was conducted on the carbon-impregnated foam in a vapor test apparatus to study adsorption dynamics. A mathematical model was developed up to the breakthrough time, i.e., the run time at which the exiting vapor concentration is 5 percent of the inlet concentration. The organic constituents of sweat were shown to cause the poisoning action, results indicated that lactic acid is primarily responsible. The possibility of increasing the capacity of the existing foam material by radiation treatment was studied, but with inconclusive, results. To reduce the deleterious effects of sweat on the adsorptive properties of carbon impregnated foam material, the possibility of selective removal of lactic acid was studied. This was accomplished by chemically modifying an undershirt material to give it ion exchange properties. Dissert. Abstr.

N76-30809*# Technology, Inc., Houston, Tex. Life Sciences Div.
FOOD DEPOT: APOLLO-SOYUZ TEST PROJECT Final Report
Charles T. Bourland 26 Aug. 1975 67 p
(Contract NAS9-13291)
(NASA-CR-147858) Avail: NTIS HC $4.50 CSCL 06H

The Food Depot operations required to produce the ASTP Food System, the food system and some analysis and recommendations related to future operations are described. Author

N76-30810*# General Electric Co., Philadelphia, Pa. Space Div.
MODULAR BIOWASTE MONITORING SYSTEM CONCEPTUAL DESIGN
G. L. Fogal Oct. 1974 149 p
(Contract NAS9-13748)
(NASA-CR-147867; Doc-74SD4254) Avail: NTIS HC $6.00 CSCL 06B

The objective of the study was to define requirements and generate a conceptual design for a Modular Biowaste Monitoring System for specifically supporting shuttle life science experimental and diagnostic programs. Author

N76-30811*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
HUMAN FACTORS ENGINEERING AND TECHNICAL PROGRESS
V. F. Rubakhin Washington NASA Mar. 1976 18 p refs Transl. into ENGLISH from Vestnik AN SSSR (USSR), no. 11, Nov. 1975 p 59-66
(Contract NASw-2789)
(NASA-TT-F-16931) Avail: NTIS HC $3.50 CSCL 05E

The present state of human factors engineering and its basic theoretical foundations are reviewed. At present, it is concerned with elaborating the methodological foundations for developing control systems for complex industrial processes, optimizing the flow and structure of information within these systems, and determining the technical and practical feasibility of automating human production. Certain generally accepted principles of human factors engineering are discussed, and theoretical and practical work by a number of researchers is reviewed. A significant improvement in the effectiveness of research in aerospace technology is noted. The establishment is suggested of a Human Factors Engineering Service, which would have three divisions concerned with design of man machine systems, monitoring and control of work quality, and selection and training of specialists. Author

N76-30812*# Kanner (Leo) Associates, Redwood City, Calif.
PROBLEMS OF SPACE BIOLOGY. VOLUME 28: EXPERIMENTAL ECOLOGICAL SYSTEMS INCLUDING MAN
I. I. Gitelson, B. G. Kovrov, G. M. Lisovskiy, Yu N. Okladnikov, M. S. Rerberg, F. Ya. Sidko, and I. A. Terskov Washington NASA Jun. 1976 351 p refs Transl. into ENGLISH of the book "Problemykosmicheskoy biologii. Tom 28. Experimental'nyye ekologicheskiye sistemy vklyuchayushchiye cheloveka" Moscow, Nauka Press, 1975 p 1-312
(Contract NASw-2790)
(NASA-TT-F-16993) Avail: NTIS HC $10.50 CSCL 06K

The monograph is devoted to analysis of the problems of creation of a human life support system, based on the biological cycle of matter, and to experimental implementation of such systems. Questions of the ecology and technology of the links which form the system are examined; special attention is given to small closed ecosystems, as a new subject of investigation. The physiological reactions of man living in an experimental ecological system are described. The scientific and applied prospects of further development and use of artificial ecological systems, for solution of space and terrestrial problems, are discussed. Author

N76-30813*# Food and Drug Administration, Cincinnati, Ohio. Div. of Microbiology.
ECOLOGY AND THERMAL INACTIVATION OF MICROBES IN AND ON INTERPLANETARY SPACE VEHICLE COMPONENTS Quarterly Progress Report, 1 Apr. - 30 Jun. 1976
A. L. Reyes, J. E. Campbell, A. J. Wehby, R. G. Crawford, J. C. Wimsatt, and J. T. Peeler Aug. 1976 9 p refs
(NASA Order W-13411)
(NASA-CR-148004; QPR-45) Avail: NTIS HC $3.50 CSCL 06M

The thermal resistance of vegetative cells in the percent RH range of 0.19 to 100 at 60 C was investigated. Staphylococcus aureus was used in the experiment because of the extension of the moisture range that can be examined. Author

N76-30814*# Martin Marietta Aerospace, Denver, Colo.
PAYLOAD/ORBITER CONTAMINATION CONTROL REQUIREMENT STUDY: PRELIMINARY CONTAMINATION MISSION SUPPORT PLAN
L. E. Bareiss, V. W. Hooper, and E. B. Ress 31 Aug. 1976 6 p
(Contract NAS8-31574)
(NASA-CR-149983; MCR-76-271) Avail: NTIS HC $3.50 CSCL 22B

Progress is reported on the mission support plan and those support activities envisioned to be applicable and necessary during premission and postmission phases of the Spacelab program. The purpose, role, and requirements of the contamination control operations for the first two missions of the Spacelab equipped Space Transportation System are discussed. The organization of the contamination control operation and its relationship to and interfaces with other mission support functions is also discussed. Some specific areas of contamination to be investigated are treated. They are: (1) windows and viewports, (2) experiment equipment, (3) thermal control surfaces, (4) the contaminant induced atmosphere (as differentiated from the normal ambient atmosphere at the orbit altitude), and (5) optical navigation instruments. Author

N76-30815*# Life Systems, Inc., Cleveland, Ohio.
SOLID ELECTROLYTE OXYGEN REGENERATION SYSTEM Interim Report, 26 Sep. 1973 - 31 Mar. 1976
J. W. Shumar, G. G. See, F. H. Schubert, and J. D. Powell Jul. 1976 201 p refs
(Contract NAS2-7862)
(NASA-CR-137813; LSI-ER-190-12) Avail: NTIS HC $7.75 CSCL 06K

A program to design, develop, fabricate and assemble a one-man, self-contained, solid electrolyte oxygen regeneration system (SX-1) incorporating solid electrolyte electrolyzer drums was completed. The SX-1 is a preprototype engineering model designed to produce 0.952 kg (2.1 lb)/day of breathable oxygen (O2) from the electrolysis of metabolic carbon dioxide (CO2) and water vapor. The CO2 supply rate was established based on the metabolic CO2 generation rate for one man of 0.998 kg (2.2 lb)/day. The water supply rate (0.254 kg (0.56 lb)/day) was designed to be sufficient to make up the difference between the 0.952 kg (2.1 lb)/day O2 generation specification and the O2 available through CO2 electrolysis, 0.726 kg (1.6 lb)/day. The SX-1 was successfully designed, fabricated and assembled. Design verification tests (DVT) or the CO Disproportionators, H2 separators, control instrumentation, monitor instrumentation, water feed mechanism were successfully completed. The erratic occurrence of electrolyzer drum leakage prevented the completion of the CO2 electrolyzer module and water electrolyzer module DVT's and also prevented the performance of SX-1 integrated testing. Further development work is required to improve the solid electrolyte cell high temperature seals. Author

N76-30816# Southampton Univ. (England). Inst. of Sound and Vibration Research.
THE EVALUATION OF HUMAN EXPOSURE TO HELICOPTER VIBRATION
Michael J. Griffin Sep. 1975 46 p refs
(Contract MIN-DEF-AT/2040/0165/AE)
(ISVR-TR-78) Avail: NTIS HC $4.00

The form of a new procedure for evaluating helicopter vibration is described. Guidance to aircraft designers is offered for three categories of vibration exposure: whole-body vibration of aircrew, the legibility of vibrating instruments, and local vibration of aircrew heads, hands, and feet. The derivation of the evaluation procedure is presented and areas where more research is required are defined. Examples of how the procedure may be used to evaluate helicopter vibration are given and the vibration conditions reported in some helicopters are compared with the recommended vibration limits. Author (ESA)

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

N76-30817 Texas Technological Univ., Lubbock.
EFFECTIVE COMPUTER ARCHITECTURE FOR MICROPROGRAMMED MACHINES Ph.D. Thesis
Robert Winston Nowlin 1975 182 p
Avail: Univ. Microfilms Order No. 76-17759

Effective computer architectures for microprogrammed machines for computing specific problems such as matric-vector products, Gaussian elimination, and digital filtering were studied. The major tool used in this investigation was the development of microinstructions and microprograms. When such routines are microprogrammed a considerable reduction in computing time is accomplished and some memory space is saved. General purpose algorithms are developed for calculating computation times for these tasks and comparisons are made with computation times required for machine language programmed versions.
Dissert. Abstr.

N76-30818 Washington Univ., Seattle.
GRAPHS AND LOG(N)-SPACE BOUNDED TURNING MACHINES Ph.D. Thesis
David Lloyd Fish 1975 78 p
Avail: Univ. Microfilms Order No. 76-17468

The problem is considered of whether two sets of graphs are equal: the set of graphs accepted by nondeterministic log(n)-space bounding Turing machines and the set of graphs accepted by deterministic log(n) space bounded Turing machines. It is shown that all first order graph properties are deterministically recognizable in log(n)-space. Furthermore, the sets of nondeterministically acceptable graphs are exactly those which can be characterized by a portion of the second order theory of graphs. A new reducibility is defined which is finer than the log(n)-space reducibility. A number of new problems are shown to be complete in nondeterministic log(n)-space under this reducibility.
Dissert. Abstr.

N76-30819 Maryland Univ., College Park.
DYNAMIC PROBLEM ORIENTED REDEFINITION OF COMPUTER ARCHITECTURE VIA MICROPROGRAMMING Ph.D. Thesis
Tomlinson Gene Rauscher 1975 220 p
Avail: Univ. Microfilms Order No. 76-18707

An examination of architecture redefinition using sequences and using dynamic program structure suggests combining the two approaches. As a result, the problem can be reformulated as a linear programming problem. From a consideration of this model evolves the procedure for architecture redefinition, i.e.,

for generating new machine instructions that support the program being compiled. The expected improvements of a redefined architecture over a standard architecture, in terms of memory space and execution time, are expressed analytically. Several items concerned with the implementation of the architecture redefinition procedure are considered. These include determining transition probabilities between blocks in the program, designing a basic machine language, deciding the types of microprograms to generate, and handling subprograms in the Markov model of structured programs. Dissert. Abstr.

N76-30820*# Utah Univ., Salt Lake City.
UNIVERSITY OF UTAH (WALLOPS) PRECISION METEOROLOGICAL DATA DIGITIZER Dept. of Electrical Engineering
Forrest L. Staffanson 16 Jul. 1975 38 p
(Contract NAS6-1908)
(NASA-CR-141412; UTEC-75-104) Avail: NTIS HC $4.00 CSCL 09B

The data digitizing system takes pulsed signals from meteorological rocket sondes and radiosondes and converts the information (the time interval between pulses) into a digital form for magnetic recording and further processing by digital computer. The basic digitizer configuration contains a master sequencer that allows for data storage and release in an accumulator. Thus, the digitizer provides for convenient interfacing in real time monitoring. G.G.

N76-30821*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LUMIS INTERACTIVE GRAPHICS OPERATING INSTRUCTIONS AND SYSTEM SPECIFICATIONS
Nevin A. Bryant, Tong C. Yu, and Albert J. Landini 15 Aug. 1976 101 p ref
(Contract NAS7-100)
(NASA-CR-148764; JPL-SP-43-31) Avail: NTIS HC $5.50 CSCL 09B

The LUMIS program has designed an integrated geographic information system to assist program managers and planning groups in metropolitan regions. Described is the system designed to interactively interrogate a data base, display graphically a portion of the region enclosed in the data base, and perform cross tabulations of variables within each city block, block group, or census tract. The system is designed to interface with U. S. Census DIME file technology, but can accept alternative districting conventions. The system is described on three levels: (1) introduction to the systems's concept and potential applications; (2) the method of operating the system on an interactive terminal; and (3) a detailed system specification for computer facility personnel. Author

N76-30822# Rockwell International Corp., Anaheim, Calif. Autonetics Group.
MAGNETIC BUBBLE MEMORIES
John Ypma 12 Apr. 1976 5 p refs Submitted for publication
(X76-380/501) Avail: NTIS HC $3.50

A brief overview of the progress in bubble domain memory is provided. A listing of companies engaged in bubble research is provided, along with a listing of systems in work at the various locations. The position of bubble systems relative to other available technologies is given, with emphasis upon the natural split between serial loop bubble systems and minor loop designs for block access. Serial and block access system block diagrams are discussed. Finally, projections of continued device improvements intended to provide lower cost systems through smaller bubbles, fault tolerant designs, cheaper substrate materials and self-biased films are given. Author

N76-30823# Rockwell International Corp., Anaheim, Calif. Electronics Research Div.
BUBBLE MATERIALS CHARACTERIZATION USING SPATIAL FILTERING
R. D. Henry 15 Jul. 1976 12 p refs Submitted for publication
(X76-835/501) Avail: NTIS HC $3.50

A technique for bubble materials characterization is described which utilizes spatial filtering. This method of characterization is amenable to automation, and the resolution actually improves as the bubble diameter is decreased from 4 micrometer to 1 micrometer. The technique of spatial filtering is then applied to the problem of magnetic defect detection to produce instant defect maps of large areas. Author

N76-30824# Standard Electrik Lorenz A.G., Stuttgart (West Germany).
DATA STORAGE ONBOARD SATELLITES WITH STORAGE CAPACITIES FROM 25 Mbit TO 1000 Mbit [STUDIE UEBER DATENSPEICHERUNG IN SATELLITEN BEI SPEICHERKAPAZITAETEN VON 25 Mbit BIS 1000 Mbit]
Milan Florjancic and Roland Liebscher Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1975 183 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-WRT-2073; GfW-RV-11-V43/73)
(BMFT-FB-W-75-26) Avail: NTIS HC $7.50; ZLDI, Munich DM 38.45

Various storage media were studied which could be used in future mass memories for space applications, providing a capacity of 25 to 1,000 Mbit. The principles are briefly reviewed; new knowledge and developments are dealt with in detail. Memory types surveyed are: semiconductor, MNOS, CCD, magneto-optical, ferrite core, plated wire, oligatomic, magnetic bubble, and magnetic tape. The analysis of the principles and the comparison of the memory types indicate the preferability of the magnetic tape recorder at present and of the magnetic bubble memory in the near future. The draft specifications of such a memory are compiled. Author (ESA)

N76-30825# IBM Federal Systems Div., Owego, N.Y.
PROGRAM DOCUMENTATION FOR THE VOLTSCAN PROGRAM
J. J. Miller, Jr. Jan. 1976 28 p
(Contract F33615-75-C-5152; AF Proj. 7184)
(AD-A021919; AMRL-TR-76-13; HESS-76-2) Avail: NTIS CSCL 09/2

The Voltscan Program provides the capability to graphically display four channels of digitized analog samples. The program was written for an IBM System/370, Model 155 computer operating under the standard MFT version of the Operating System. Assembler language and FORTRAN were used in coding the program. The IBM 2250 Graphics Programming Services were utilized for the graphic software support. Author (GRA)

N76-30826# Utah Univ., Salt Lake City.
MOVIE-NUC: A COMPUTER PROGRAM TO DISPLAY TWO- AND THREE-DIMENSIONAL MODELS AS LINE DRAWINGS OR CONTINUOUS-TONE COLOR IMAGES Research Report, Dec. 1974 - Dec. 1975
L. E. McCleary (Naval Undersea Center), H. N. Christiansen (Brigham Young Univ.), and B. E. Brown Dec. 1975 43 p refs
(Contract N00123-74-C-0781; SF1121602)
(AD-A022594; NUC-TP-501) Avail: NTIS CSCL 09/2

MOVIE-NUC is a general-purpose computer graphics display system for two-and three-dimensional models. The results of both static and dynamic analyses may be viewed as line drawings, continuous-tone color images or as an animated movie sequence. MOVIE-NUC uses the Watkins' Visible Surface Algorithm to produce realistic perspective views of the model with the hidden lines and surfaces removed. The system is written in FORTRAN and is run on the Naval Undersea Center Univac 1108 and 1110 computers in either an interactive or batch mode.
Author (GRA)

N76-30827# Colorado State Univ., Fort Collins. Dept. of Mathematics.
EVALUATION OF THE SQUARE ROOT FUNCTION ON MICROPROCESSORS Interim Report
M. Andrews, S. F. McCormick, and G. D. Taylor 1976 23 p refs
(Grants AF-AFOSR-2878-76; NSF GJ-42626; AF Proj. 9749)
(AD-A023134; AFOSR-76-0379TR) Avail: NTIS CSCL 09/2

The software requirements for real time applications of microprocessors have received little attention from the scientific community. This reflects the need for the development of efficient algorithms to evaluate special functions for such purposes. The aim of this paper is to report on initial efforts to develop software for evaluation of the square root function in microprocessors

utilizing fixed point computation. Numerical results of the performance of these algorithms are described for both eight and sixteen bit precision machines. Author (GRA)

N76-30828# Teledyne Geotechnical, Alexandria, Va. Seismic Data Analysis Center.
THE RTDCOM PROTOCOL: A REAL-TIME INTERCOMPUTER DATA TRANSMISSION PROTOCOL FOR THE ARPA NETWORK
Edwin W. Meyer, Jr. 20 May 1975 34 p refs
(Contract F08606-74-C-0006; ARPA Order 1620; VT Proj. 4709)
(AD-A021687; SDAC-TR-75-7) Avail: NTIS CSCL 09/2

This document presents an ARPA Network Protocol for real-time high volume intercomputer data transmission using prearranged non-switched data communication channels. This protocol deletes unnecessary and cumbersome aspects of the standard (NCP) ARPANET protocol and adds features intended to strengthen data integrity and to avoid error and loss due to network instability and outrage. A special feature enables automatic switching of the data channel to alternate IMP ports in case a site changes its configuration. This protocol is suitable for use with either the IMP Regular Message (type 0) or the newly introduced Uncontrolled Packet (type 3). GRA

N76-30829# RAND Corp., Santa Monica, Calif.
ADVANCED INTELLIGENT TERMINALS AS A USER'S NETWORK INTERFACE
R. H. Anderson Jun. 1975 11 p refs Presented at the IEEE COMPCON 1975 Conf., Washington, D. C., 9-14 Sep. 1975
(AD-A021705; P-5445) Avail: NTIS CSCL 09/2

Computer networks are creating a serious problem: increasing numbers of users can access a variety of different information systems. Unlike a set of application programs residing in a single computer, these different information systems have very little in common. They were built for different communities of users, by differing groups of programmers, to run on different hardware configurations, and with very different protocols for man/machine interaction. In addition, the network itself may not be transparent to the user; it may require login procedures and access protocols. Networks also can cascade the number of serial components being used to accomplish a task; using the ARPANET as an example, one might interact with a remote system via a local host computer, the Interface Message Processor (IMP) which connects it to the network, possibly several intervening IMPs, the remote host computer's IMP, and the remote system's host computer. A failure in one of these components creates the need for rather complex strategies for gracefully 'backing out' of the other systems, preferably leaving some intermediate results intact so that a later 'restart' procedure can be initiated. GRA

N76-30830# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
EVALUATION, REVISION AND APPLICATION OF THE NBS STYLUS/COMPUTER SYSTEM FOR THE MEASUREMENT OF SURFACE ROUGHNESS Final Technical Report
Clayton E. Teague Apr. 1976 154 p
(PB-251689/6; NBS-TN-902) Avail: NTIS HC $6.75 CSCL 09B

The hardware and software used to implement on a stylus instrument/minicomputer system, the process of calibrating the system with an interferometrically measured step and the calculation of important characterizations of surface profiles is described in detail. The characterizations of a profile which may be calculated include the arithmetic average value, the mean square value, the amplitude density function, the autocorrelative function and the average wavelength. A statistical evaluation, using empirical and analytical techniques, of the calibration procedures' long term stability is also included. Author (GRA)

N76-30831# Utah Univ., Salt Lake City. Dept. of Computer Science.
SENSORY INFORMATION PROCESSING AND SYMBOLIC COMPUTATION Semiannual Report, 1 Jan. - 30 Jun. 1975
Thomas G. Stockham, Jr. Jun. 1975 140 p refs
(Contract DAHC15-73-C-0363; ARPA Order 2477)
(AD-A022094; UTEC-CSC-76-008) Avail: NTIS CSCL 09/2

This research uses digital computation to investigate processes, both linear and nonlinear, for the filtering, restoration enhancement, bandwidth reduction, distortion immunization and analysis of both visual and auditory information. GRA

N76-30832# Illinois Univ., Urbana. Coordinated Science Lab.
VISUAL UNDERSTANDING OF HYBRID CIRCUITS VIA PROCEDURAL MODELS: AN APPROACH TO AUTOMATIC INSPECTION OF HYBRID CIRCUITS Ph.D. Thesis
Wesley Edwin Snyder Dec. 1975 128 p refs
(Contract DAAB07-72-C-0259)
(AD-A022095; R-703; UILU-ENG-75-2239) Avail: NTIS CSCL 09/2

This report is concerned with the fundamental and practical problems of visual image processing in a real world environment. An understanding of the concepts associated with recognizing a visual image is essential if we are to develop any kind of functional computer visual recognition. Visual recognition is the act of associating a perceived object with a model in one's memory. The association need not be and in fact seldom is an exact match, but it rather depends on the correlation of a set of features and the knowledge of the context in which the image is perceived. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N76-30833 Stanford Univ., Calif.
HYBRID CONJUGATE GRADIENT ALGORITHMS Ph.D. Thesis
Dianne Prost OLeary 1976 118 p
Avail: Univ. Microfilms Order No. 76-18790

The development of computationally efficient and more stable variations of the standard conjugate gradient algorithm for problems in which the Jacobian matrix is symmetric and positive definite were studied. Specific applications considered are associated with the solution of finite difference discretizations of elliptic partial differential equations. The use of the conjugate gradient iteration to calculate eigenvalues while iterating to the solution of a system of equations, and the use of matrix splitting techniques to improve the convergence properties of the conjugate gradient algorithm are demonstrated to be two effective tools for the solution of elliptic partial differential equations under finite difference discretizations. These methods should also be valuable in the solution of finite element discretizations and other matrix problems with nonrandom sparsity. Dissert. Abstr.

N76-30834 Stanford Univ., Calif.
AUTOMATIC VERIFICATION OF PROGRAMS WITH COMPLEX DATA STRUCTURE Ph.D. Thesis
Norihisa Suzuki 1976 260 p
Avail: Univ. Microfilms Order No. 76-18803

Pascal was chosen as the target language. The semantics and proof rules were studied. In order to express the state of the data structures concisely and express the effects of statements special assertion language primitives and new proof rules were introduced. New methods of introducing functions and predicates to write assertions were introduced so that simplification rules and proof search strategies can be expressed. A special language to document properties of these functions and predicates was introduced. These methods enable users to express assertions in natural ways so that verification becomes easier. The theorem prover is constructed so that it will be efficient for proving a type of formulas which appears very often as verification conditions. Dissert. Abstr.

N76-30835 Case Western Reserve Univ., Cleveland, Ohio.
A COMPUTER-ASSISTED INSTRUCTION LANGUAGE WHICH INTERACTS WITH THE AUTHOR Ph.D Thesis
James Larue Rogers 1975 98 p
Avail: Univ. Microfilms Order No. 76-16073

In the last 15 years, computers have been used in several different parts of the instructional process, and for several different

purposes. Part one of this dissertation examines each of these kinds of applications in order to identify the circumstances under which CAI author languages are used, and to describe precisely how they function. Part two of this dissertation reviews the findings of three studies to determine what, if any, importance is given to the CAI author's ability to prepare self-instructional materials. Part three begins by examining a comprehensive model of the process of preparing self-instructional materials, to see which steps in that process lend themselves to computerization. This is followed by a sample authoring session, showing the interaction between an instructor and a program designed to help him organize a CAI program to teach a concept.
Dissert. Abstr.

N76-30836 Ohio Univ., Athens.
ALGORITHMS FOR THE SOLUTION OF LINEAR INEQUALITIES Ph.D. Thesis
Sen-Hsiung Cheng 1976 152 p
Avail: Univ. Microfilms Order No. 76-18443

A problem of considerable importance in pattern recognition, threshold switching theory, and mathematical programming is to find a solution x, an n-vector, for the linear inequalities $Ax>0$, where A is a given m x n matrix with $m>n$. A set of linear inequalities is said to be consistent if it has a solution; otherwise, it is said to be inconsistent. Four algorithms were developed to treat the problem of solving the linear inequalities of either the consistent or the inconsistent type. Ho-Kashyap's algorithms were used in the first two algorithms. The eigenvectors approach was also implemented to avoid the matrix inversion involved in Ho-Kashyap's algorithms. Modifications were made to cause the rapid convergence of the algorithms. In the third algorithm, a property of the Penrose generalized inverse matrix was used and the so-called linear combination method was developed to find a solution which satisfies as many inequalities as possible. The third algorithm was simplified to formulate the fourth algorithm by directly using the columns of the given matrix of the linear inequalities. Dissert. Abstr.

N76-30837 Ohio State Univ., Columbus.
COMPARISON OF SELECTED ALGORITHMS FOR IDENTIFICATION OF LINEAR NOISY SYSTEMS Ph.D. Thesis
James Bullock Price 1976 228 p
Avail: Univ. Microfilms Order No. 76-18024

Selected algorithms were evaluated for the off-line identification of parameters which occur in the model equations for a class of physical systems. This class includes time dependent physical systems characterized as linear, constant coefficient, single input - single output systems with Gaussian, white measurement noise only. One algorithm considered was the linear least squares analysis or the maximum likelihood technique. Another algorithm used was stochastic approximation. Correlation techniques were also used: one was the normal correlation method; the other added a pseudo-random sequence of 17 bits to the system input. Conjugate gradient techniques were employed using the same cost function and system model as the least squares analysis. For these seven algorithms and their associated computer codes simulated data reactor data, (Experimental Breeder Reactor-II) and biological data (Canine Renal System) were used for comparison. The different algorithms were compared using simulated data by varying noise variance, system order, and sample size. Dissert. Abstr.

N76-30838 Texas A&M Univ., College Station.
THE CORRECTIVE GRADIENT PROJECTION METHOD, AND SOME ADAPTIVE ALGORITHMS FOR LINEARLY CONSTRAINED ARRAY PROCESSING Ph.D. Thesis
Bok Sub Byun 1975 121 p
Avail: Univ. Microfilms Order No. 76-17342

The Corrective Gradient Projection (CGP) method is described for the problem of optimizing a nonlinear function (called the objective function) of multiple parameters subject to a system of linear constraint equations. This scheme was derived geometrically by modifying the Gradient Projection method of Rosen (1960) and is specially designed to correct for any deviation of the parameters from the constraints at every iteration. Therefore, the CGP method can be applied to those problems where large numbers of iterations are required without accumulating these deviations. The CGP method was applied to the problem of adaptive, linearly constrained array processing, that is, the problem of minimizing the expected noise power in real time while maintaining a certain frequency response to the target signal. A different (and more straightforward) approach, called the constraint elimination technique, is also described for the constrained array processing problem. It was verified by simulation experiments that the CGP method maintains the deviations of the parameters from the constraints to a minimum.
Dissert. Abstr.

N76-30839 Pennsylvania State Univ., University Park.
SPATIAL AND SPECTRAL FILTERING AS APPLIED TO ARRAY PROCESSING Ph.D. Thesis
Frank Wallace Symons, Jr. 1975 286 p
Avail: Univ. Microfilms Order No. 76-17236

Algorithms have been developed that can be flexibly applied to the processing of discrete directional interference, out-of-band look-direction interference, and in-band look-direction interference, all of which are frequently encountered in array processing. Discrete directional interference is handled by a recursive adaptive LMS processor which steers linear array pattern nulls to spatially filter the interference. The form of the processor is controlled by choosing the elements of a selection matrix in its interference estimation channel. The selection matrix chooses subsets of the input array for use in forming an estimate of the interference which is subtracted from the output of a uniform array which is used to focus on the look-direction waveforms. These algorithms, considered as subsystems, were used in cascade in a digital simulation to form a spatial/spectral system for the efficient rejection of all combinations of the types of interference considered. Dissert. Abstr.

N76-30840 Washington Univ., Seattle.
TRELLIS ENCODING OF CONTINUOUS-AMPLITUDE, DISCRETE-TIME INFORMATION SOURCES Ph.D. Thesis
Stephen Gayne Wilson 1975 233 p
Avail: Univ. Microfilms Order No. 76-17688

The encoding of discrete-time continuous-amplitude information sources with respect to a distortion criterion is investigated, focussing on trellis encoding methods as a means of closely approaching the theoretical limit on transmission efficiency specified by rate distortion theory. Two trellis encoding algorithms, the Viterbi and M algorithms, are evaluated via simulation for various independent, identically distributed sources as well as Gaussian sources with memory under a squared-error distortion measure. For the Gaussian memoryless source model, investigation is made of the achieved average distortion versus number of trellis paths retained for the two algorithms. On an equal-paths-retained basis, a superiority of the M algorithm is demonstrated, and with this procedure average distortion is within about one dB of the theoretical distortion limit at a rate of four bits/symbol when 75 paths are retained by the encoder. This performance is superior to that of coded quantizers or permutation codes.
Dissert. Abstr.

N76-30841 Washington Univ., Seattle.
ANALYSIS AND SIMULATION OF GRAPH MODELS Ph.D. Thesis
Charles Patrick Crowley 1976 173 p
Avail: Univ. Microfilms Order No. 76-17448

A graph model called system nets is defined. The model is a modification of the Petri net model with an interpretation added and is very similar to the E-net model. The interpretation adds data attributes to the tokens, decision algorithms and time delays to the model. The addition of the interpretation makes the model useable as a simulation programming language. A simulator program for system nets was implemented and is described. The use of reachability graphs (i.e., state graphs) is introduced as a tool for the analysis of uninterpreted system net models. It is shown to be useful in determining such properties as: (1) liveness (related to deadlock-freeness), (2) maximum parallelism or maximum resource usage, (3) mutual exclusion, (4) proper sequencing of selected events, (5) reachability of selected states, and (6) transient behavior. A new method called ordering is also presented which reduces the size of the reachability graph by giving priority to certain kinds of transitions and thereby pruning unessential parts of the reachability graph.
Dissert. Abstr.

N76-30842 Michigan Univ., Ann Arbor.
DATA STRUCTURES: SPECIFICATION AND REALIZATION Ph.D. Thesis
Francois Marc Bancilhon 1976 245 p
Avail: Univ. Microfilms Order No. 76-19074

A general model for the study of data structures is presented. It is shown that two levels must be distinguished. The relational level (data specification) and the access-path level (data realization). At each of these levels, the notions of configuration (state of the data at a given time) and of schema (set of possible configurations) were defined and justified. The model was then structured by the introduction of a notion of equivalence between relational configurations. This definition was extended, thus giving a first definition of the equivalence of two schemata. Similarly, the notion of realization of a relational schema by an access-path schema was defined. From these definitions, it was argued that there is not one theory of data structures but many theories of data structures, according to the precise notions of schema and equivalence that one chooses. A specific example of a data structure problem (data structure optimization) was also studied. Dissert. Abstr.

N76-30843 Washington Univ., Seattle.
C2: A SUPER-COMPILER APPROACH TO AUTOMATIC PROGRAMMING Ph.D. Thesis
Ted James Biggerstaff 1976 311 p
Avail: Univ. Microfilms Order No. 76-17402

Automatic programming research is considered a process of inventing compilers for a series of increasingly more powerful languages. Each language in the series allows programs to be stated in a more concise, less explicit manner than the previous language in the series. C2 represents that class of compilers which, for every language statement input, produce hundreds of machine instructions as output. In contrast, the C1 languages FORTRAN, APL, PL/I and all other currently existing programming languages produce tens of instructions per line of source code. A C2 language allows the programmer to express his problem in truly problem oriented terms, e.g., SORT array A, rather than language oriented terms. The concept of a C2 compiler is demonstrated through implementation of one simple statement type of a C2 language, a statement for combining LISP-like lists. Dissert. Abstr.

N76-30844*# Technology, Inc., San Antonio, Tex. Life Sciences Div.
A SOFTWARE SYSTEM FOR ACQUISITION OF LOWER BODY NEGATIVE PRESSURE TEST DATA USING VARIAN 6201
John G. Groves, III 9 Apr. 1973 113 p
(Contract NAS9-13291)
(NASA-CR-150935) Avail: NTIS HC $5.50 CSCL 09B

The hardware configurations and the software development for the Varian system to acquire the raw data related to the Skylab Experiment M092-Lower Body Negative Pressure (LBNP) were described. The format in which the data is entered is illustrated. The program was written in Varian assembly language, and includes a section that is interactive with the user through the teletype. The technique for entering input data is described. The following appendices are included: (1) source listing of the Varian program, (2) flow charts of essential routines, and (3) source listing of VCON, which converts Varian generated data tapes to Sigma 3 data tapes. Y.J.A.

N76-30845*# Ohio Univ., Athens. Dept. of Electrical Engineering.
TEST PROGRAM FOR 4-K MEMORY CARD, JOLT MICROPROCESSOR
Robert W. Lilley Aug. 1976 5 p
(Grant NGR-36-009-017)
(NASA-CR-148770; TM-33) Avail: NTIS HC $3.50 CSCL 09B

A memory test program is described for use with the JOLT microcomputer 4,096-word memory board used in development of an Omega navigation receiver. The program allows a quick test of the memory board by cycling the memory through all possible bit combinations in all words. Author

N76-30846*# M&S Computing, Inc., Huntsville, Ala.
SIGMA 2 GRAPHIC DISPLAY SOFTWARE PROGRAM DESCRIPTION
B. T. Johnson 19 Jan. 1973 107 p refs
(Contract NAS8-25621)
(NASA-CR-149965; Rept-73-0003) Avail: NTIS HC $5.50 CSCL 09B

A general purpose, user oriented graphic support package was implemented. A comprehensive description of the two software components comprising this package is given: Display Librarian and Display Controller. These programs have been implemented in FORTRAN on the XDS Sigma 2 Computer Facility. This facility consists of an XDS Sigma 2 general purpose computer coupled to a Computek Display Terminal. Author

N76-30847*# M&S Computing, Inc., Huntsville, Ala.
BANNING PRF PROGRAMMER'S MANUAL
R. L. Kuelthau 30 Dec. 1970 165 p
(Contract NAS8-25621)
(NASA-CR-149969; Rept-70-0036) Avail: NTIS HC $6.75 CSCL 09B

This manual describes a modification of the Banning placement routing folding program. The modifications to this program have been made to implement it on a Sigma 5 computer. Flow charts of various levels, beginning with high level functional diagrams and working down to the level of detail deemed necessary to understand the operations of the various sections of the program are included. Along with the flow charts of each subroutine is a narrative description of its functional operation and definitions of its arrays and key variables, and a section to assist the programmer in dimensioning the program's arrays. Author

N76-30848*# M&S Computing, Inc., Huntsville, Ala.
NTRAN USER'S MANUAL
E. R. Pitts 30 Jul. 1975 74 p
(Contract NAS8-25621)
(NASA-CR-149970; Rept-75-0028) Avail: NTIS HC $4.50 CSCL 09B

Information is presented for the use of NTRAN (Network TRANslator), a program written in FORTRAN that provides a means for generating input files for the LOGSIM and LASAR programs from PRF and PR2D input decks. The program technical description, input instructions, and deck setup instructions for the Sigma 5 computer, are presented to familiarize the reader with the software. Author

N76-30849*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STANDARDIZED DEVELOPMENT OF COMPUTER SOFTWARE. PART 1: METHODS
Robert C. Tausworthe Jul. 1976 389 p refs
(Contract NAS7-100)
(NASA-CR-148762; JPL-SP-43-29-Pt-1) Avail: NTIS HC $10.75 CSCL 09B

This work is a two-volume set on standards for modern software engineering methodology. This volume presents a tutorial and practical guide to the efficient development of reliable computer software, a unified and coordinated discipline for design, coding, testing, documentation, and project organization and management. The aim of the monograph is to provide formal disciplines for increasing the probability of securing software that is characterized by high degrees of initial correctness, readability, and maintainability, and to promote practices which aid in the consistent and orderly development of a total software system within schedule and budgetary constraints. These disciplines are set forth as a set of rules to be applied during software development to drastically reduce the time traditionally spent in debugging, to increase documentation quality, to foster understandability among those who must come in contact with it, and to facilitate operations and alterations of the program as requirements on the program environment change. Author

N76-30850# California State Univ., San Jose. Dept. of Speech-Communication.
PROXVAL PROGRAM DESCRIPTION
Kenneth K. Kirste and Peter R. Monge Dec. 1975 28 p ref
(Contract N00014-75-C-0445; NR Proj. 170-763)
(AD-A022141; TR-5) Avail: NTIS CSCL 09/2

This report describes five computer programs written to augment the network analysis of communication patterns within a complex organization provided by NEGOPY. All are written in FORTRAN IV and are designed for execution under a disc-based IBM 360/70 operating system. The five are: PROXVAL, EXTENDB, EXTENDA, COMCUM, and CONVERT. PROXVAL calculates the proximity of individuals within the organization providing a value which represents one individual's physical relationship to all others and providing proximity for all combinations of pairs of individuals. Program EXTENDB combines PROXVAL calculations of an individual's proximity to all others. Up to 99 PROXVAL runs can be combined (3,564 locations). Program EXTENDA combines PROXVAL calculations of the proximity of every pair (up to 99 PROXVAL runs). Program COMCUM totals each individual's reported communication, providing a listing of the total amount of communication each engages in. Program CONVERT was introduced to convert data collected from specific channels to total communication data. GRA

N76-30851# Oxford Univ. (England). Dept. of Engineering Science.

FEASIBILITY STUDY OF THE APPLICATION OF MICROPROCESSORS TO SELF-TUNING CONTROLLERS

D. W. Clarke, S. N. Cope, and P. J. Gawthrop 1975 100 p refs Sponsored in part by Sci. Res. Council

(OUEL-1137/75) Avail: NTIS HC $5.00

A specific coding for a self-tuning controller operating on an Intel 8080-based microcomputer was developed which verifies the applicability of microprocessors in this area. Several stages were taken: (1) theoretical improvements to the self-tuning regulator philosophy to broaden the class of systems that can be controlled and to improve the control characteristics; (2) development of appropriate software for the 8080, based largely on the use of the Macro assembler of a PDP 11/45 computer, for: cross-assembling Intel 8080 mnemonic code; simulating and debugging 8080 programs using the PDP 11/45; manipulating floating-point numbers by the 8080; providing an intermediate-level language for writing 8080 programs; and handling a high-speed asynchronous data link between the PDP 11 and the 8080-based microcomputer; and (3) Specific coding of the self-tuning controller for the 8080, verified by a comparison of results with those obtained by the FORTRAN simulation on the PDP 11/45. Author (ESA)

N76-30852# Royal Observatory, Edinburgh (Scotland).

COMPUTATIONS FOR ASTRONOMICAL FOURIER TRANSFORM SPECTROSCOPY

J. M. Stewart 18 Dec. 1974 37 p refs

HC $4.00

The background and basic operation of programs written to compute infrared spectra from interferograms are described. The interferograms are obtained using a rapid scan interferometer, many scans being coadded to produce an interferogram with an improvement in signal to noise ratio. The interferograms are sampled at a frequency of 4 kHz using a He-Ne laser beam as a reference. The interferograms are recorded on analog magnetic tape after having been passed through filters reducing out-of-band noise, but introduce large phase shifts distorting the interferogram. Interferograms are digitized at 16,000 samples, with the peak a few hundred samples from one end, and coadded to produce the data set. Two programs have been written in FORTRAN to transform the interferogram and to apply phase corrections to the spectrum and to the interferogram. ESA

N76-30853# Royal Observatory, Edinburgh (Scotland).

COMPUTATION OF INFRARED SPECTRA FROM INTERFEROGRAMS

J. M. Stewart Jul. 1975 18 p refs

Avail: NTIS HC $3.50

The various computing stages between the analog tape recording of the interferogram and the final stellar spectrum are described. They are digitizations of the interferogram scans, coadding scans into one interferogram, transformation to spectrum, combination of spectra, correction for terrestrial absorption, and plotting and interpolation of spectra. ESA

N76-30854# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.

GUIDE TO THE NPL ALGORITHMS LIBRARY

D. R. B. Bish and J. R. A. Cooper Feb. 1976 77 p refs

(NPL-NAC-64) Avail: NTIS HC $5.00

The guide consists of three parts: a listing of recently produced routines, a listing of earlier routines, and an alphabetical listing of all routines covered by the guide. For each routine, information relating to the purpose, outline, authors, and language is given. ESA

N76-30855# Naval Postgraduate School, Monterey, Calif.

EPSILON - OPTIMALITY FOR A GLOBAL OPTIMIZATION ALGORITHM

James K. Hartman Dec. 1975 14 p refs

(RR0000101)

(AD-A021915; NPS-55Hh75121) Avail: NTIS CSCL 12/1

The optimality conditions for a nonconvex global optimization algorithm are generalized to include epsilon - tolerances on the computations. The class of problems for which the new conditions imply epsilon optimality is investigated and shown to be quite broad. GRA

N76-30856# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.

FAST ALGORITHMS FOR PARTIAL FRACTION DECOMPOSITION Interim Report

H. T. Kung and D. M. Tong Jan. 1976 28 p refs

(Contract N00014-76-C-0370; Grant NSF MCS-75-22255; NR Proj. 044-422)

(AD-A022807) Avail: NTIS CSCL 12/1

The partial fraction decomposition of a proper rational function whose denominator has degree n and is given in general factored form can be done in O(n (log n) squared) operations in the worst case. Previous algorithms require O x N cubed operations, and O(n (log n) squared) operations for the special case where the factors appearing in the denominator are all linear. GRA

N76-30857# Boeing Aerospace Co., Seattle, Wash.

USERS MANUAL FOR SUPERSAP2 Final Report

J. L. Cooke, J. J. Schwartz, D. E. Duncan, and L. H. Skinner Kirtland AFB, New Mex. AFWL Feb. 1976 208 p refs Prepared in cooperation with BDM Corp., Albuquerque, New Mex.

(Contract F29601-74-C-0008; AF Proj. 3763)

(AD-A022979; D224-13047-2; BDM/A-120-74-TRR1; AFWL-TR-75-70) Avail: NTIS CSCL 09/2

This report presents user information for the computer code SUPERSAP2. SUPERSAP2 is a data storage and retrieval program. It is designed to manipulate data from two large data bases in support of EMP susceptibility threshold analysis. The Component Data Base contains data on approximately 86,000 electronic component types. The System Description Data Base is user defined. SUPERSAP2 uses a command language to provide user control of a variety of data manipulations. Author (GRA)

N76-30858# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Guidance and Control Directorate.

COMPUTER SIMULATION OF CONTROL SYSTEM CONTAINING DIGITAL HARDWARE

S. M. Seltzer Dec. 1975 22 p refs

(DA Proj. 1MB-62303-8-214)

(AD-A022255; RG-76-33) Avail: NTIS CSCL 09/2

This report describes an approach that may be used to develop a simulation which employs some digital hardware in the guidance and control loop. The approach is applied to portions of the T-6 digital autopilot data processor. Author (GRA)

N76-30859# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.

DOD WEAPON SYSTEMS SOFTWARE MANAGEMENT STUDY

A. Kossiakoff, T. P. Sleight, E. C. Prettyman, J. M. Park, and P. L. Hazan Jun. 1975 207 p refs

(Contract N00017-72-C-4401)

(AD-A022160; APL-JHU-SR-75-3) Avail: NTIS CSCL 09/2

This report to the Office of the Secretary of Defense

summarizes the findings of a Weapon System Software Management Study and presents 17 recommendations directed to the alleviation of the more serious problems encountered. The first part of the report contains a discussion of the study objectives and a summary of the recommendations including suggested implementations. Subsequent sections present material from which the recommendations were derived: a review of 10 major previous DoD studies, reviews of 10 Navy and 2 Army Weapon Systems, and summaries of discussions with service organizations and industrial software system contractors. Further discussions of the recommendations and identification of areas requiring further investigation are presented. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N76-30860 Georgia Inst. of Tech., Atlanta.
THEORETICAL AND COMPUTATIONAL ASPECTS OF INTEGER MULTICOMMODITY NETWORK FLOW PROBLEMS Ph.D. Thesis
James Robert Evans 1975 178 p
Avail: Univ. Microfilms Order No. 76-16501

The nature of integer solutions in multicommodity network flow problems is investigated. A relationship between matroid theory, network flows, and integer programming is developed, and the results are applied to prove that a certain class of multicommodity transportation problems have totally unimodular constaint matrices and can be solved by equivalent single commodity network flow problems. A simple graph-theoretic condition is derived by which one can determine when a specific basis or all bases to a multicommodity flow problem will yield integer solutions. The combinatorial complexity of the integer multicommodity transportation problem is discussed, and a heuristic algorithm is developed. Applications of integer programming techniques to general multicommodity flow problems are also considered. Dissert. Abstr.

N76-30861 Maryland Univ., College Park.
A STUDY OF THE PERFORMANCE OF COMPUTER SYSTEMS USING ADVANCED SECONDARY MEMORIES Ph.D. Thesis
Charles Bruce Izard 1975 164 p
Avail: Univ. Microfilms Order No. 76-17808

The performance is analyzed of computer systems which have secondary memories with improved performance by comparison to the same systems with existing secondary memories. The performance of the CPU's varies from that of small general purpose processors to that of very large scientific processors. The advanced technology secondary memories have the transfer-rate and access-time characteristics that can be projected for CCD (charge coupled device) and magnetic bubble memories. The computer system model included job stream, hardware, and operating system components. The performance of the systems was compared using cost/performance criteria. The results of the simulation and analysis indicate that large advanced technology secondary memories will not be cost effective additions to the small and mid range general purpose computer systems but appear to be a cost effective addition for the high performance computer systems. Dissert. Abstr.

N76-30862 Stanford Univ., Calif.
A VERIFIED SPECIFICATION OF A HIERARCHICAL OPERATING SYSTEM Ph.D. Thesis
Ashok Raj Saxena 1976 252 p
Avail: Univ. Microfilms Order No. 76-18798

This thesis discusses the design, specification, and verification of computer operating systems. The operating system problem considered, the many process problem, is the design of an operating system that can support a large number of concurrent processes. This design problem is a vehicle to investigate the use of a design methodology, the hierarchical levels of abstraction methodology; the use of structured programming techniques in the specification of the system; and the development of techniques for the verification of concurrent programs, particularly operating system programs. A solution to the many process problem is obtained, and it is shown that the hierarchical levels of abstraction methodology simplifies the conception of the solution and help avoid potential deadlocks in the system. Dissert. Abstr.

N76-30863 Iowa State Univ. of Science and Technology, Ames.
CONTROLLED INFORMATION SHARING IN THE SYMBOL-2R COMPUTER SYSTEM Ph.D. Thesis
Hamilton Richards, Jr. 1976 191 p
Avail: Univ. Microfilms Order No. 76-18290

This thesis describes a high-level information storage and sharing system, i.e., a file system that accommodates user-programmed sharing controls, and shows how it is superimposed upon the SYMBOL-2R multiprocessor computer system hardware and how it interacts with various of SYMBOL-2R's hard-wired algorithms. Two novel aspects of SYMBOL-2R are discovered to have contributed substantially to such simplicity, integrity, and efficiency as the SYMBOL file system exhibits: (1) SYMBOL-2R's absolute-addressed Virtual Storage system defines a unique context-independent address for every storage location, which forms the basis for simple and efficient sharing of stored information; and (2) SYMBOL-2R's high-level Interpreter, whose context-dependent attribution of meaning to programs' variable names is responsible for the isolation of independent computations, provides the basic protection that is essential to the control of information sharing and the maintenance of the system's integrity. Dissert. Abstr.

N76-30864 Ohio State Univ., Columbus.
SYSTEM DESIGN OF THE DISTRIBUTED LOOP COMPUTER NETWORK (DLCN) Ph.D. Thesis
Cecil Clay Reames 1976 252 p
Avail: Univ. Microfilms Order No. 76-18028

Three areas of its system design are considered: the loop communication network, the message communication protocol, and the distributed network operating system. For the loop network, a novel message transmission mechanism which is superior to any in use today was developed and implemented in the loop interface hardware. The superior performance claimed for this mechanism was verified by GPSS computer simulation. Operating with completely distributed control, it: (1) allows direct and simultaneous transmission of variable length message frames onto the loop: (2) permits nearly immediate access to the loop by temporarily delaying incoming messages: (3) automatically regulates loop traffic according to system load: and (4) vastly improves message transmission times and loop utilization. Dissert. Abstr.

N76-30865*# Boeing Commercial Airplane Co., Seattle, Wash.
AIRBORNE ADVANCED RECONFIGURABLE COMPUTER SYSTEM (ARCS) Final Report, Mar. 1975 - Apr. 1976
B. E. Bjurman, G. M. Jenkins, C. J. Masreliez, K. L. McClellan, and J. E. Templeman Aug. 1976 547 p refs
(Contract NAS1-13654)
(NASA-CR-145024; D6-42476) Avail: NTIS HC $13.00 CSCL 09B

A digital computer subsystem fault-tolerant concept was defined, and the potential benefits and costs of such a subsystem were assessed when used as the central element of a new transport's flight control system. The derived advanced reconfigurable computer system (ARCS) is a triple-redundant computer subsystem that automatically reconfigures, under multiple fault conditions, from triplex to duplex to simplex operation, with redundancy recovery if the fault condition is transient. The study included criteria development covering factors at the aircraft's operation level that would influence the design of a fault-tolerant system for commercial airline use. A new reliability analysis tool was developed for evaluating redundant, fault-tolerant system availability and survivability; and a stringent digital system software design methodology was used to achieve design/implementation visibility. Author

N76-30866# RAND Corp., Santa Monica, Calif.
COST IMPLICATIONS OF PRIVACY PROTECTION IN DATABANK SYSTEMS
Rein Turn Apr. 1975 27 p refs
(AD-A022186; P-5321) Avail: NTIS CSCL 09/2

In the context of personal information data bank systems,

the term privacy is being used to represent a set of rights relative to personal information of an individual data subject on whom identifiable personal data are being maintained in a data bank, regarding the collection, storage, processing, dissemination, and use of information on his personal attributes and activities. The costs of implementing privacy protection requirements in personal information data bank systems comprise the initial cost of setting up the protection system, and the recurrent operation costs. Legislation is now pending in the U.S. and other countries, on national as well as local levels, to codify various rights that individual citizens have relative to personal information stored on them in computerized data bank systems. J.A.M.

N76-30867# Texas Univ., Austin. Center for Cybernetic Studies.
IMPROVED LABELING OF LP BASES IN NETWORKS
Fred Glover (Colorado Univ.) and Darwin Klingman Oct. 1975 13 p refs
(Contract N00126-74-C-2275; NR Proj. 047-021)
(AD-A022692; CCS-218-Rev) Avail: NTIS CSCL 09B

New labeling techniques are provided for accelerating the basis exchange step of specialized linear programming methods for network problems. These techniques substantially reduce the amount of computation involved in updating operations.
Author (GRA)

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N76-30868 Washington Univ., Seattle.
A GENERAL APPROACH TO LEARNING PATTERN RECOGNITION SYSTEMS Ph.D. Thesis
Adil Muren Gokeri 1975 145 p
Avail: Univ. Microfilms Order No. 76-17477

A starting point for a new general theory for pattern recognition (PR) systems is provided. In addition, the design of a computer system called OTTOMAN is described. The theory is based on a set of definitions and hypotheses. Basically, it is proposed that general PR systems define patterns in terms of other simpler patterns (i.e., features) either learned previously or included in a primitive set of patterns called 'innate patterns'. It is argued that these innate patterns are available to PR systems at 'birth'. Furthermore, in forming descriptive pattern structures, a set of relations is assumed available to all PR systems with which the features of patterns are interrelated. Five theorems provide the requirements for relation sets. The pattern structures thus formed are represented by 'weighted digraphs' which could similarly be stored in the memory of any PR system. Finally, a decision making algorithm is defined for determining the degree of similarity between any pattern structures. This provides the basis for recognition of an 'event' occurring in the 'Universe'.
Dissert. Abstr.

N76-30869 Pennsylvania State Univ., University Park.
INTERPRETATION OF INFRARED SPECTRA USING PATTERN RECOGNITION TECHNIQUES Ph.D. Thesis
Robert William Lidell, III 1975 104 p
Avail: Univ. Microfilms Order No. 76-17187

A brief introduction to the theory and implementation of binary pattern classifiers (BPCs) is given, followed by a discussion of their application to the interpretation of infrared spectra. These BPCs have the ability to predict the chemical classes of unknown spectra with a high degree of success. Four different methods are used to generate classifiers, and the classifiers' predictive abilities are compared. The pattern classifiers have been used in conjunction with three different feature selection routines, and it is shown that a small fraction of the data is necessary to classify these infrared spectra successfully into chemical classes. In addition to the BPCs trained and feature selected for infrared classification, a program has been developed employing arrays of adaptive BPCs to generate complete chemical structures consistent with an input molecular formula and spectroscopic data. Currently, it has the capability to use the low resolution mass spectrum and the infrared spectrum of an unknown. Dissert. Abstr.

N76-30870# Technische Universitaet, Hanover (West Germany). Lehrstuhl fuer Arbeitsmaschinen und Fabrikanlagen.
INDUSTRIAL ROBOTS IN JAPAN. REPORT ON A TECHNICAL VISIT TO JAPAN FROM 16 NOVEMBER TO 2 DECEMBER 1974 [INDUSTRIEROBOTER IN JAPAN. REISEBERICHT UEBER DIE FACHSTUDIENREISE NACH JAPAN VOM 16 NOV. BIS 2. DEZ. 1974]
Hans Kettner, Gottfried Stoevesandt, and Bernd H. Auer (Tech. Univ., Berlin) Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1975 65 p In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-75-39) Avail: NTIS HC $4.50; ZLDI, Munich DM 13,65

The 4th International Symposium on Industrial Robots (Nov. 19 - 21, 1974, Tokyo), the simultaneous exhibition of Industrial Robots (IR), and eight visits to research centers, manufacturers, and users of IR are reported. The topics of the symposium were: locomotion of IR; detecting and recognizing parts by TV-camera; tactile sensors for inserting operations; coordinated control of two arms; control by force control; programming language ROBOTLAN; simple branching-control; mechanisms; and industrial applications of IR. The exhibition included: arc welding by IR, assembly of IR with automatic hand change, and assembly by IR with sensor-hand. The trip gave a general view of Japan's research, development, and application in the field of IR.
Author (ESA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N76-30871 Washington Univ., Seattle.
ARRANGEMENTS OF LINES GENERATED BY POLYGONS IN THE EUCLIDEAN PLANE Ph.D. Thesis
Thomas Owen Strommer 1975 92 p
Avail: Univ. Microfilms Order No. 76-17648

The set of lines in the Euclidean plane determined by extending the edges of a (convex or non-convex) polygon are considered. The major results deal with the number of lines which may be obtained in this way if the number of edges in the polygon is fixed and how many points of intersection there may be among these lines. For the case where the polygon P has n edges, exact bounds on the minimum number of lines which may be obtained by extending the edges of P whenever n does not equal 1/2 k(k-1) for some odd integer k are determined. When n=1/2 k(k-1) for k an odd integer, this minimum is determined to within one in all cases and exactly when k=3 or k=5. It is also shown that whenever n does not equal 6, it is possible for the lines obtained by extending the edges of P to have any number of distinct points of intersection between n and 1/2 n(n-1) inclusive. When n=6, the number of points must be between 7 and 15. Further, there are no other possibilities for any value of n. The problem of deciding whether an arbitrary set of lines in the plane may be obtained by extending the edges of some polygon is also considered. Dissert. Abstr.

N76-30872 North Carolina State Univ., Raleigh.
BOUNDEDNESS OF SOLUTIONS TO DIFFERENTIAL EQUATIONS USING LYAPUNOV TECHNIQUES Ph.D. Thesis
John Frederick Wiggs 1975 61 p
Avail: Univ. Microfilms Order No. 76-17262

The equation x'=f(t,x) is considered where f:/0,infinity) x R sup n approaches R sup n is continuous. The functions U and V studied are, where U is Lyapunov-type function on a set E which is contained in R sup N, V is a Lyapunov-type function on R sup n, and a relationship is assumed between their Dini derivatives on E. Results are obtained which guarantee that no noncontinuable solution to the initial value problem x'=f(t,x) with x(t sub 0)=x sub 0 has finite escape time and that all solutions to the initial value problem are bounded in the future (provided V is sufficiently well-behaved with respect to (t sub 0,x sub 0)

outside of E when the absolute value of x is large). A split system of uncoupled ordinary differential equations and an associated coupled perturbation of this system are also considered. Assuming the existence of a Lyapunov function with negative definite derivative along solutions of one equation of the system and a Lyapunov function with positive definite derivative along solutions to the second equation, the existence of an n sub 1 parameter family of bounded solutions to the perturbed system on /0,infinity) is proved. Dissert. Abstr.

N76-30873 Wisconsin Univ., Madison.
APPROXIMATE SOLUTION OF GENERALIZED HAMILTONIAN EQUATIONS WITH APPLICATIONS Ph.D. Thesis
Jose Vitorio Zago 1976 118 p
Avail: Univ. Microfilms Order No. 76-16028

Four areas were discussed: (1) approximate solutions obtained by the Ritz-Rayleigh (or finite element) method are analyzed. The approximate solution was shown to be the projection of the exact solution into the subspace generated by the trial functions, with respect to a new inner product; (2) bounds are given on the norm of the difference between the exact solution and any solution of (alpha) or (beta); (3) dual extremum principles for the heat equation are obtained using, general Hamiltonian structure; and (4) approximate solutions to the heat equation obtained by using the principles derived previously were derived. A simple example is worked out in detail and a preliminary effort is made to use cubic splines. The theoretical results are illustrated by some numerical examples. Dissert. Abstr.

N76-30874 Stanford Univ., Calif.
NUMERICAL METHODS FOR NONLINEARLY CONSTRAINED OPTIMIZATION Ph.D. Thesis
Margaret Ann Hagen Wright 1976 270 p
Avail: Univ. Microfilms Order No. 76-18814

A new feasible-point algorithm for nonlinearly constrained optimization is described. The new method is based on the properties of the trajectory of minima obtained by varying the barrier parameter of the logarithmic barrier function. The algorithm is closely related to a nonfeasible-point method based on the trajectory of the quadratic penalty function, due to Walter Murray, and this method is also described. The search direction in the trajectory algorithms is determined by solving a quadratic programming subproblem whose objective function is based on an approximation to the Lagrangian function. This subproblem is well-posed whatever the value of the penalty or barrier parameter, unlike the determination of the search direction for penalty and barrier function methods. Dissert. Abstr.

N76-30875 North Carolina State Univ., Raleigh.
A TEST FOR NONLINEARITY IN THE GENERAL MULTIPLE LINEAR REGRESSION MODEL BASED UPON SQUARED DIFFERENCES BETWEEN PAIRS OF RESIDUALS Ph.D. Thesis
Nancy Irene Lyons 1975 89 p
Avail: Univ. Microfilms Order No. 76-17254

A test for nonlinearity in a multiple linear regression model is developed for cases in which there are insufficient or no replications available for estimation of the variance of random error about the model. The test is recommended as an alternative to the usual F test for lack of fit when there are few observations. The test statistic r is expressed as the ratio of two estimates of the error variance - the average of the squared differences between pairs of residuals associated with near-neighbor pairs of the independent variable, and the error mean square. The Mahalanobis generalized interpoint distance is used as the criterion for determining the near-neighbor pairs. Dissert. Abstr.

N76-30876 Cornell Univ., New York.
SOME CONTRIBUTIONS TO THE THEORY OF NONADDITIVITY IN DATA ANALYSIS Ph.D. Thesis
Rama Chandran Nair 1976 86 p
Avail: Univ. Microfilms Order No. 76-18176

Likelihood ratio tests for nonadditive alternate models were developed which take into account the error structure under both hypotheses. The case where both hypotheses have the same error structure, viz., additive normally distributed errors (usually with homogeneous variances), was considered. The tests are all asymptotic and involve computation of solutions to nonlinear equations. The powers of some of these tests are computed and compared with other tests. Nonadditivity in mixed models is discussed and the difficulty in employing the usual tests of fixed models explored. In this context, it is also shown how the assumption of independence of main effects and interactions in a mixed model can be erroneous. Suggestions are also made for the analysis of data in the presence of nonadditivity using the maximum likelihood procedure. Solutions for parameters in some specific designs, using a multiplicative model, are obtained, and tests of hypotheses about these parameters are discussed. Dissert. Abstr.

N76-30877 Stanford Univ., Calif.
ESTIMATION AND TESTING FOR BLOCK COMPOUND SYMMETRY AND OTHER PATTERNED COVARIANCE MATRICES WITH LINEAR AND NON-LINEAR STRUCTURE Ph.D. Thesis
Ted Howard Szatrowski 1976 187 p
Avail: Univ. Microfilms Order No. 76-18805

Several problems in the area of testing and estimation of patterned covariance matrices in multivariate analysis were studied. Maximum likelihood estimators (MLE) were derived for the estimation problems, and likelihood ratio tests (LRT) were used for testing problems. Approximate or asymptotic distributions of the LRT were performed using the Box (1949) approximation or standard delta method (Cramer, 1946). The problems that were studied included cases where explicit MLE are found and where the MLE are solutions to quadratic, cubic or higher degree polynomials. For cases where the MLE could not be explicitly found, computational procedures were suggested and difficulties in implementation discussed. Sufficient conditions for explicit MLE, single iteration convergence and a method of averaging yielding the MLE for patterned covariance matrices were considered. Dissert. Abstr.

N76-30878 Washington Univ., Seattle.
CONVERGENCE OF THE SEQUENTIAL UNIFORM EMPIRICAL PROCESS WITH BOUNDS FOR CENTERED BETA RANDOM VARIABLES AND A LOG-LOG LAW Ph.D. Thesis
Jon August Wellner 1975 75 p
Avail: Univ. Microfilms Order No. 76-17680

Several new inequalities for the behavior of the uniform and sequential uniform empirical processes near zero are obtained. Exponential bounds for the tail probabilities of centered beta random variables are proved and used to establish inequalities for central absolute moments of beta random variables and almost sure nearly linear bounds for the empirical distribution function. The new inequalities are used to strengthen both weak and iterated logarithm convergence results for the processes (with emphasis on iterated logarithm type convergence) from uniform (rho) to stronger than uniform (rho sub q) metrics. A law of the iterated logarithm for linear combinations of order statistics follows as an application. Dissert. Abstr.

N76-30879 Washington Univ., Seattle.
HIERARCHIES OF CONFORMING FINITE ELEMENTS Ph.D. Thesis
Alberto Giovanni Peano 1975 91 p
Avail: Univ. Microfilms Order No. 76-18425

A new approach to the finite element method is presented. The new approach exploits the demonstrated efficiency of high order polynomial interpolations and provides control over the discretization error. This is accomplished by devising a hierarchy of conforming approximations based on complete polynomial sequences of arbitrary order which form a basis for the solution space. This task is relatively simple when the continuity conditions for linear elasticity must be satisfied, but it is quite difficult for problems requiring C prime continuous approximations such as Kirchoff bending of shells and plates. The problem of enforcing C prime continuity over a general mesh for arbitrary polynomial orders is discussed in detail. Dissert. Abstr.

N76-30880 Ohio State Univ., Columbus.
CHARACTERIZATIONS OF TWO FINITE SIMPLE GROUPS Ph.D. Thesis
Robert Paul Markot 1976 84 p
Avail: Univ. Microfilms Order No. 76-18006

Recently simple groups denoted by E and F were discovered by Conway, Fischer, Harada and Thompson. The first chapter of this thesis is concerned with the characterization of E by a 2-local subgroup of E. Chapter two deals with a characterization of the simple group F by the centralizer of a central involution. Dissert. Abstr.

N76-30881# Naval Research Lab., Washington, D.C.
DERIVATION OF EQUILIBRIUM AND TIME-DEPENDENT SOLUTIONS TO M/M/INFINITY/N AND M/M/INFINITY QUEUEING SYSTEMS USING ENTROPY MAXIMIZATION Interim Report
John E. Shore Mar. 1976 25 p refs
(NRL Proj. MR-3233; RR0140241)
(AD-A022370; NRL-BO2-35; RR-0140241) Avail: NTIS CSCL 12/1

Conventional approaches to the solution of queueing and similar stochastic problems use differential equations in the probabilities or probability densities of appropriate system states. Although this approach has had widespread success, it has some conceptual difficulties. It is the author's opinion that work by R. T. Cox and E. T. Jaynes may offer a better conceptual foundation for the study of stochastic processes. The purpose of this report is to support that opinion by illustrating the application of the Cox-Jaynes approach to the analysis of M/M/infinity/ /N and M/M/infinity queueing systems. Both equilibrium and time-dependent distributions are derived. GRA

N76-30882# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
A MODIFIED SUBSET SELECTION FORMULATION WITH SPECIAL REFERENCE TO ONE-WAY AND TWO-WAY LAYOUT EXPERIMENTS
Deng-Yuan Huang and S. Panchapakesan Oct. 1975 17 p refs
(Contract N00014-75-C-0455)
(AD-A022389; Mimeo-Ser-440) Avail: NTIS CSCL 12/1

The usual formulation of subset selection due to Gupta (1956) requires a minimum guaranteed probability of a correct selection. The modified formulation of the present paper includes an additional requirement that the expected number of the non-best populations be bounded above by a specified constant when the best and the next best populations are 'sufficiently' apart. A class of procedures is defined and the determination of the minimum sample size required is discussed. The specific problems discussed for normal populations include selection in terms of means and variances, and selection in terms of treatment effects in a two-way layout. Author (GRA)

N76-30883# North Carolina Univ., Chapel Hill. Dept. of Statistics.
BOUNDS AND THE EVALUATION OF RATE DISTORTION FUNCTIONS Interim Report
Hoi Ming Leung Feb. 1976 131 p refs
(Grant AF-AFOSR-2796-75; AF Proj. 9769)
(AD-A023148; Mimeo-Ser-1057; AFOSR-76-0325TR) Avail: NTIS CSCL 12/1

Contents: Introduction to Rate Distortion Functions; The Rate Distortion Functions with Respect to the Square-Error Criterion of a Memoryless Gaussian Vector Source Whose Components Have Fixed Variances; The Rate Distortion Functions with Respect to the Square-Error Criterion of Spherically Invariant Sources; Rate Distortion Functions of Certain Memoryless Sources with Respect to the Magnitude-Error Criterion; and Bounds to Rate Distortion Functions with Respect to the Magnitude-Error Criterion. GRA

N76-30884# RAND Corp., Santa Monica, Calif.
THE USE OF INTERNAL INSTRUMENTS FOR ERRORS IN VARIABLES AND MISSING CROSS PRODUCTS
Eric A. Hanushek and Finis Welch Feb. 1975 20 p refs
(AD-A022177; P-5369) Avail: NTIS CSCL 12/1

Theoretically, the most satisfying technique for dealing with errors in variables has been the use of instrumental variables. However, the operational difficulty of finding appropriate instruments has led to a lack of use of the technique, to the extent that theoretical discussions of errors in variables are even disappearing from the texts. This paper has developed a method of constructing instruments whenever one set of independent variables is measured without error and one set is measured with error. GRA

N76-30885# Naval Research Lab., Washington, D.C.
A 1975 LEAST-SQUARES ADJUSTMENT OF VALUES OF THE FUNDAMENTAL CONSTANTS Interim Report
Warren L. Bendel Jan. 1976 26 p refs
(NRL Proj. H01-60; RR0120641)
(AD-A021191; NRL-MR-3213) Avail: NTIS CSCL 07/4

After the 1973 report on the fundamental constants by Cohen and Taylor, a new measurement of Avogadro's constant, (N sub A), was published by Deslattes et al. Based on improved techniques, the result is considerably more precise than the 1973 value, which was based primarily on other types of data, and is 8.2 ppm (1.6 times the 1973 standard deviation) larger. In the present report, a new least-squares adjustment is made, with six parameters and using the measurement of (N sub A) plus other new data. Recommended values of 75 constants are presented, half of which differ from the former values by 1.0 to 1.5 times the 1973 standard deviation. The uncertainties of the new values are often much less than the 1973 uncertainties, 0.38 as large according to one figure of merit. GRA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo methods; and stochastic processes.

N76-30886 Tennessee Univ., Knoxville.
THE BOTTLENECK TRAVELING SALESMAN PROBLEM Ph.D. Thesis
Kenneth Carl Gilbert 1976 82 p
Avail: Univ. Microfilms Order No. 76-17723

A variation of the traveling salesman problem with a bottleneck type objective function is posed. A statistical analysis shows that for large problems in which the costs are independent identically distributed random variables, the optimal objective function value is almost deterministic and can be approximated using a Beta function. Two branch and bound methods of solution are proposed; the first based on an arborescence relaxation, the second based on an assignment problem relaxation. An analysis shows that the second relaxation is more powerful in terms of the fraction of its solutions which are feasible for the original problem. Similar arguments and computational results show that problems with symmetric and euclidian costs are more difficult to solve. As an alternative method of solution a computationally efficient heuristic is developed. Computational experience reveals that the solutions obtained using this heuristic are often optimal. Dissert. Abstr.

N76-30887 Princeton Univ., N.J.
MODELING OF RANDOM PHENOMENA Ph.D. Thesis
James Howard Gilchrist 1975 182 p
Avail: Univ. Microfilms Order No. 76-18487

Random phenomena are modeled based on the assumption that events occur in bursts or groups rather than individually. Four models, based on the same mathematical equations, are considered. The models differ in the specification of the occurrence times of bursts or groups and in the specification of the occurrence times of the events within a burst. Both random times and uniformly separated times are considered. For each model, at least one example is given of the application to the modeling of a naturally occurring random phenomena. Models are provided such as I/f noise, lightning, corona on a -c transmission lines, and block coded data transmission systems. Experimental results found in the literature are used to determine model parameters, and the model predictions are compared with other measured quantities. Dissert. Abstr.

N76-30888 Princeton Univ., N.J.
SEQUENTIAL ESTIMATION IN FINITE AND INFINITE DIMENSIONAL SYSTEMS Ph.D. Thesis
Giovanni Colantuoni 1975 237 p
Avail: Univ. Microfilms Order No. 76-18486

A unified treatment of sequential estimation in finite and

infinite dimensional stochastic systems is presented following an operator and function space approach. The system dynamics and the measurement processes are represented in the general operator formulism and subsequently, utilizing Baye's rule for the realization of the estimate of the state of the system, a set of relationships is developed which describes the evolution of the state estimate and the covariance operator. Such relationships are expressed in the operator and component or kernel form as well, and are valid for systems with continuous dynamics and measurement processes which are continuous or intermittent in time. A procedure is also presented for the optimal selection of measurement configurations for such sequential estimation problems. Dissert. Abstr.

N76-30889 North Carolina State Univ., Raleigh.
THE APPLICATION OF A CONFIDENTIALITY TRANSFORMATION TO OBSERVATIONS FROM A SIMPLE LINEAR REGRESSION MODEL Ph.D. Thesis
Gipsie Bush Ranney 1975 105 p
Avail: Univ. Microfilms Order No. 76-17255

Information about individuals maintained in data files by government and private agencies may be rendered unidentifiable when disseminated in order to protect the privacy of the individual. One method of doing this is to randomly permute all or some of the observations on sensitivie items prior to the release of the data. The effects of a transformation procedure on estimation and testing for a simple linear regression model with the sensitive item as the dependent variable are studied. Least squares estimators of mu and beta in the model are discussed. A test of the hypothesis beta = 0 and its power are discussed, and the results of small sample simulators are given. The asymptotic efficiency of this test based on transformed data relative to the usual test based on the original observations is found for certain asymptotic properties of the observations on the independent variable. Dissert. Abstr.

N76-30890 Wisconsin Univ., Madison.
THE MONTE CARLO SOLUTION OF NONLINEAR SYSTEMS Ph.D. Thesis
Shih Chieh Hsu 1976 131 p
Avail: Univ. Microfilms Order No. 76-15993

The sequential Monte Carlo method is applied to the solution of large systems of nonlinear equations. To simulate a broad class of deterministic solution methods, an adaptive iterative skeleton is defined, from which sequence Monte Carlo schemes can be designed by providing suitable random variables. Given conditions on variances, which can be ensured through dynamically picking large enough sample sizes, theorems on the mean convergence and on the rate of mean convergence are developed. For a very important class of deterministic iterative methods, practical Monte Carlo schemes are constructed. Under certain conditions, their variances are shown to decrease along with the convergence of the schemes; and the expected values of sample sizes to achieve the desired rate of convergence are shown to be bounded. Dissert. Abstr.

N76-30891*# Houston Univ., Tex. Dept. of Mathematics.
THE NUMERICAL EVALUATION OF MAXIMUM-LIKELIHOOD ESTIMATES OF THE PARAMETERS FOR A MIXTURE OF NORMAL DISTRIBUTIONS FROM PARTIALLY IDENTIFIED SAMPLES
Homer F. Walker Jun. 1976 17 p refs
(Contract NAS9-15000)
(NASA-CR-147857; Rept-54) Avail: NTIS HC $3.50 CSCL 12A

Likelihood equations determined by the two types of samples which are necessary conditions for a maximum-likelihood estimate are considered. These equations, suggest certain successive-approximations iterative procedures for obtaining maximum-likelihood estimates. These are generalized steepest ascent (deflected gradient) procedures. It is shown that, with probability 1 as N sub 0 approaches infinity (regardless of the relative sizes of N sub 0 and N sub 1, i = 1,...,m), these procedures converge locally to the strongly consistent maximum-likelihood estimates whenever the step size is between 0 and 2. Furthermore, the value of the step size which yields optimal local convergence rates is bounded from below by a number which always lies between 1 and 2. Author

N76-30892# California Univ., Berkeley. Operations Research Center.
BAYESIAN LIFE TESTING USING THE TOTAL Q ON TEST
W. S. Jewell Jan. 1976 35 p refs
(Grants DAHC04-75-G-0163; DAAG29-76-G-0042)
(AD-A022384) Avail: NTIS CSCL 12/1

Suppose the basic shape of the cumulative failure (hazard) function has been identified for a certain component, and that an unknown parameter theta for a new production run of similar components is to be estimated. In particular, suppose that the failure function is of proportional type where Q is the known shape function, and that theta is sampled from a prior gamma density. By using a new statistic, called the Total Q on Test (TQT), it is possible to perform Bayesian updating during a variety of lifetime testing programs in a manner similar to total time on test plots. This statistic can also be used with complete lifetime data, extending over several product runs, to identify the failure form Q, and to estimate the gamma hyperparameters. Extensions include the use of several TQT statistics to estimate the relative strength of competing hazard functions. GRA

N76-30893# California State Dept. of Transportation, Sacramento. Transportation Lab.
DEVELOPMENT OF A CORRELATION PROGRAM Interim Report
Paul E. Benson Jun. 1975 56 p refs Sponsored by FHA, Washington, D. C.
(PB-252341/3; CA-DOT-TL-1153-5-75-06; Rept-631153)
Avail: NTIS HC $4.50 CSCL 12A

A statewide correlation program aimed at improving test method reproducibility is discussed. Statistical methods such as analysis of variance, regression analysis, principal components analysis and nonparametric analysis are used for developing an integrated program of interlaboratory testing. Four computer programs using these methods are presented. Guidelines for conducting a correlation program are given. GRA

N76-30894# RAND Corp., Santa Monica, Calif.
SIMULTANEOUS BAYESIAN ESTIMATION OF MULTIVARIATE NORMAL PARAMETERS
S. James Press May 1975 28 p refs Presented at the Bayesian Seminar, Chicago, May 1975
(Grant NSF GS-42866)
(AD-A021704; P-5438) Avail: NTIS CSCL 12/1

Results involving the estimation of general sigma, and estimation of theta in the presence of unknown sigma are presented. Two stage priors are used and an exchangeability assumption relating to a prior view of the distributions of the unobservable variables is adopted. It is shown that point estimators of (theta,sigma) can be found which are convex combinations of the maximum likelihood estimators and general means (which lie in a subspace of the original (theta,sigma) space). Then, the estimation of a covariance matrix (given that the mean is zero) is discussed. An attempt is made to estimate a mean vector and a covariance matrix simultaneously, and also to estimate the mean vector conditional on knowing the covariance matrix. The results of a simulation carried out to compare the performances of the Bayesian estimators with those of classical MLE's are also presented. Author

N76-30895# RAND Corp., Santa Monica, Calif.
MISSING VARIABLES IN BAYESIAN REGRESSION
S. J. Press (British Columbia Univ.) and A. J. Scott (Auckland Univ.) Jun. 1975 13 p refs
(Grant NSF GS-42866)
(AD-A021707; P-5446) Avail: NTIS CSCL 12/1

The problem of parameter estimation in normal regression when some of the observations are missing was investigated. A Bayesian approach with vague prior distributions is taken. No assumption is made about the independent variables for which no observations are missing, but the missing components are assumed to be normally distributed with a mean that can depend on the other variables. Joint estimators of the parameters are obtained as the joint mode of the posterior distribution. GRA

N76-30896# California Univ., Berkeley. Operations Research Center.
LINEARIZED BAYESIAN ESTIMATION OF NETWORK FLOWS

William S. Jewell Jan. 1976 17 p refs
(Grant DAHC04-75-G-0163)
(AD-A022382; ORC-76-2; ARO-12549.13-M) Avail: NTIS CSCL 12/1

Suppose a problem is posed to have an imprecise estimate of arc flows in a given network, either through prior measurements under similar conditions, or through observation of related phenomena; how can this problem use imprecise measurements of boundary flows into and out of the network to improve the original estimate. This is a problem in Bayesian regression that is difficult to carry out, in general. However, by using a linearized approach due to credibility theory that is similar to results in linear filter theory, one can find interesting and useful estimates using only first and second moments of the prior observation error distributions. This result has application in road and communication traffic measurement, statistical auditing, and nuclear material accountability problems. GRA

N76-30897# Harvard Univ., Cambridge, Mass.
THE THEORY OF STOCHASTIC GAMES WITH ZERO STOP PROBABILITIES
Truman Bewley and Elon Kohlberg Jan. 1976 98 p refs
(Contract N00014-67-A-0298-0019; NR Proj. 047-004)
(AD-A022109; TR-21) Avail: NTIS CSCL 12/2

The authors study two person, zero sum, stochastic games with zero stop probabilities. Two distinct formulations are emphasized, (1) the infinite stage game with payoffs discounted at an interest rate close to zero and (2) the game with a large but finite number of stages. The authors give a complete theory of such games. The work implies all known existence theorems for optimal policies in Markov decision processes. It also generalizes all previous existence theorems for the value of a stochastic game. The approach differs from previous work in that it is algebraic and makes no use of the theory of Markov chains. The essential idea of this approach is to apply Tarski's Principle on real closed fields to a field of asymptotic expansions, which the authors term the field of real Puiseux series. GRA

N76-30898# George Washington Univ., Washington, D.C. Inst. for Management Science and Engineering.
ON THE TREATMENT OF UNCERTAINTY IN PARAMETRIC COSTING
G. R. McNichols 2 Feb. 1976 205 p refs
(Contract N00014-75-C-0729; NR Proj. 347-020)
(AD-A022153; Serial-T-330) Avail: NTIS CSCL 12/2

'Parametric costing' is a generic name used to characterize a set of techniques defining a statistical approach for predicting large scale system costs at an early stage of system design. These techniques have been employed by the Department of Defense, Aerospace and other industries extensively during recent years because the record of cost overruns in acquiring complex systems suggests that the parametric approach is not only useful but perhaps preferred to the industrial engineering or 'grass roots' approach with which it is contrasted. Predictions of cost, however, are not exact and research efforts need to be directed toward quantifying their inherent uncertainty. Previous attempts to characterize uncertainty have often been extremely naive or mathematically incorrect. The major objective of this dissertation is to examine the treatment of uncertainty in parametric costing as an applied problem in operations research. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N76-30899# Technology Service Corp., Santa Monica, Calif.
TOPICS IN THE ANALYSIS AND OPTIMIZATION OF COMPLEX SYSTEMS Final Report
William S. Meisel and Leo Breiman Jan. 1976 34 p refs
(Contract F44620-71-C-0093; AF Proj. 9749)
(AD-A023181; AFOSR-76-0153TR) Avail: NTIS CSCL 12/1

This document is a report of the results of research under AFOSR Contract No. F44620-71-C-0093 through Dec. 1975. The general thrust of the research is the development of approaches to improving the utility of computer-oriented quantitative methods in practical decision-making and system design. The research was directed at obtaining acceptable system models in two ways: (1) by repro modeling (making a more efficient model of) a complex model based on physical processes; and (2) by developing empirical models based on limited measurements of the system. Both problems are abstractly identical: In the first case, the data is obtained from a model; in the second case, from measurements on the system in question or similar systems. The abstract problem in most applications of interest is the analysis and efficient representation of the relationship between multiple input variables or parameters and an output variable. The number of input/output samples frequently are large in an absolute sense, but generally were small relative to their dimensionality. Usually the data are essentially nonlinear with complex interactions between variables. Classical statistical methods of analysis are largely inapplicable. One main effort over the contract period was in developing and extending methods designed for this type of data structures. Another effort in a parallel direction was the development of effective decision procedures based on model outputs. This resulted in methods for dealing with decision making in multicriterion situations, and in the study of tree structured decision procedures.
Author (GRA)

N76-30900# Maryland Univ., College Park. Dept. of Computer Science.
THE BASIC OPERATING SYSTEM FOR THE DISTRIBUTED COMPUTER NETWORK Interim Report
David L. Mills Oct. 1975 90 p refs
(Contract N00014-67-A-0239-0032; Grant NSF GK-41602)
(AD-A021989; TR-416) Avail: NTIS CSCL 09/2

This report describes the Basic Operating System (BOS) for the Distributed Computer Network (DCN). The BOS is a multiprogramming executive providing process and storage management, interprocess communications, input/output device control and application-program support. It operates with any PDP11 model including at least 4K of storage, an operator's console and a communication device for connection to the DCN. Included in this report is a description of the various components that make up the BOS and the manner in which they operate. Also described are the various primitive functions and command operations used to control the operation of the network and the various application programs. Other reports, listed in the references, describe the functioning of the DCN as a whole and also the upwardly-compatible Virtual operating System (VOS) developed for PDP11 models with memory management features. GRA

N76-30901# George Washington Univ., Washington, D.C. Program in Logistics.
THE EFFECT OF PRIOR ASSUMPTIONS ON THE EXPECTED COST OF M/M/1 QUEUEING SYSTEMS WITH UNKNOWN ARRIVAL RATES
Zeev Barzily and Micha Yadin (Technion-Israel Inst. of Technology, Haifa, Israel) 23 Jan. 1976 18 p refs
(Contract N00014-75-C-0729; NR Proj. 347-020)
(AD-A022120; Serial-T-329) Avail: NTIS CSCL 12/2

In this study the authors deal with the determination of optimal service rate in an M/M/1 queue. The arrival rate is unknown and assumed to be a random variable with a known distribution function. Holding and operating costs are considered and service rate is determined to minimize total expected discounted costs for infinite horizon. The effects of the arrival rate's distribution properties on the characteristics of the system are examined. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N76-30902 Iowa State Univ. of Science and Technology, Ames.
ON UNIVARIATE AND BIVARIATE EXTREME VALUE THEORY Ph.D. Thesis
Jose Aurelio Villasenor 1976 182 p
Avail: Univ. Microfilms Order No. 76-18295

In the univariate case, domains of attraction of convolutions are investigated. Let F sub 1 *F sub 2 denote the convolution of F sub 1 and F sub 2. The extreme distribution to which F sub 1 *F sub 2 is attracted is identified, assuming knowledge of the distributions to which F sub 1 and F sub 2 are attracted. These results are used in the study of limiting distributions of bivariate maxima. In the bivariate case, consideration is given to the problem of asymptotic independence of the marginal maxima, to the problem of characterization of domains of attraction, and to the problem of finding the extreme distributions for dependent bivariate samples. Dissert. Abstr.

N76-30903 American Univ., Washington, D.C.
AN INVESTIGATION OF NEAR-RINGS VIA DIGITAL COMPUTER Ph.D. Thesis
Sharon K. Hauge 1976 128 p
Avail: Univ. Microfilms Order No. 76-18817

Primary tests are provided which reduce the number of time consuming secondary tests the computer must perform in determining near rings definable on certain higher order groups. In particular, structure theorems for near rings definable on the direct sum of groups are considered. Concomitantly, examples of near rings which may be applied in the formulation of meaningful conjectures and counter-examples are given. Dissert. Abstr.

N76-30904 State Univ. of New York, Stony Brook.
CR FUNCTIONS ON TUBE MANIFOLDS Ph.D. Thesis
Michael Lee Kazlow 1976 57 p
Avail: Univ. Microfilms Order No. 76-18730

Bochner's tube theorem is generalized on the extendability of homomorphic functions. It is proven that if M is a connected locally closed submanifold in C sup n (n greater than 1) which is invariant under translations in the imaginary directions (i.e., M is a tube manifold), then every smooth solution to the tangential Cauchy-Riemann equations on M (i.e., a CR function) uniquely extends to almost all of the convex hull. Moreover, the supremum of the modulus of the extended function equals that of the original function. A notion of CR functions on tubes over connected, locally closed, locally starlike subsets of R sup n is defined. Using the techniques of several complex variables, the above stated theorem is proven. The known local CR extension theorems are then used to reduce the proof in the submanifold case to the locally starlike case. Dissert. Abstr.

N76-30905 Fordham Univ., New York.
CONTINUITY AND BOREL SETS IN COMPLETE AND IN COMPACT METRIC SPACES Ph.D. Thesis
Robert Bruce Loatman 1976 53 p
Avail: Univ. Microfilms Order No. 76-17887

If E is a set of cardinality c and f is a mapping from E into some complete separable metric space Y of dimension n, finite or infinite, the question arises as to whether there may exist a compact or a complete separable metric topology tau on E such that f is continuous when considered as a mapping on the topological space (E,tau). It is a classical result that a necessary condition for f even to be B-measurable with respect to an absolute Borel topology is that the set of points of Y of uncountable order under f be analytic. It is also known that points of uncountable order must have order c. The present paper demonstrates an additional necessary condition. Namely, for each positive integer k, the set Y sub k of points of Y of order at least k, must be analytic. In the converse direction, it is shown that if, in addition to the above conditions, each set Y sub k is Borelian, then there exists a complete separable metric topology tau of dimension zero with the required property. Dissert. Abstr.

N76-30906 Kansas Univ., Kansas City.
FIXED POINTS OF DIFFERENTIABLE MAPS IN ORDERED LOCALLY CONVEX SPACES Ph.D. Thesis
Louis Arthur Talman 1975 63 p
Avail: Univ. Microfilms Order No. 76-16786

Differentiability and asymptotic linearity conditions were examined in order to obtain fixed point theorems for a certain class of nonlinear functions which carry the positive cone of an ordered Banach space into itself. Three main theorems are proposed which establish analogous results for ordered locally convex spaces. One of the major tools used was the fixed point index theory for locally convex spaces. The general class of functions for which this theory is valid is discussed as well as a more restricted class of functions for which the index theory is more usable. Some of the notions of differentiability and asymptotic linearity along a cone in a locally convex space that were studied were the strongest and the weakest notions, which behave in a 'reasonable' way (e.g., reduce to Frechet differentiability for normed spaces). A discussion of these notions and a development of various properties are given. Dissert. Abstr.

N76-30907 Maryland Univ., College Park.
ONE-PARAMETER SEMIGROUPS OF SEMI FREDHOLM OPERATORS Ph.D. Thesis
Charles Houghton Smith 1975 52 p
Avail: Univ. Microfilms Order No. 76-18717

Two important areas of functional analysis are Fredholm theory and the theory of one-parameter strongly continuous semigroups of operators. The interactions between strongly continuous semigroups which have the property that at least one of the operators (other than the identity operator) in the semigroup is semi Fredholm were studied. It is shown that if one of the operators is semi Fredholm, then in fact all of the operators have bounded inverses or all of the operators are subjective. The term semi Fredholm semigroup is used to refer to this situation. The minimum modulus and the spectrum of an operator are basic tools for this study and are employed. Also considered is the establishment of a spectral mapping theorem relating the semi Fredholm spectrum of the infinitesimal generator and the semi Fredholm spectra of the operators of a semigroup. Dissert. Abstr.

N76-30908# Stanford Univ., Calif. Dept. of Computer Science.
ON COMPUTING THE TRANSITIVE CLOSURE OF A RELATION
James Eve Sep. 1975 16 p refs
(Contract N00014-67-A-0112-0057; Grant NSF DCR-72-03752-A02; NR Proj. 044-402) (AD-A022161; SU-STAN-CS-75-508) Avail: NTIS CSCL 12/1

An algorithm is presented for computing the transitive closure of an arbitrary relation which is based upon a variant of Tarjan's algorithm for finding the strongly connected components of a directed graph. This variant leads to a more compact statement of Tarjan's algorithm. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N76-30909 Texas A&M Univ., College Station.
MEASUREMENTS OF THE THREE COMPONENTS OF THE THERMOMAGNETIC FORCE Ph.D. Thesis
Abdul-Sattar Jawad Al-Ani 1975 58 p
Avail: Univ. Microfilms Order No. 76-17336

The thermal force was measured in the paramagnetic gases NO and O2 over a broad range of mean free paths covering the thermal force maximum. The study was done on an aluminum foil disk and a paper disk suspended between two parallel plates. The disks were oriented with their surface perpendicular to the heat flux. Measurements showed that the behavior of the thermal force near the observed maximum was explained in terms of the theory of Einstein and of the recent theories of Waldmann and Vestner, which characterize the thermal force as being proportional to the translational heat flux. The three components of the thermomagnetic force were measured using the same disks. The results indicated that the shape of H/p curves, the H/p values at which the thermomagnetic force reaches one half of its saturation value, and the location on the H/p axis where the maximum occurs, were all independent of pressure and disk composition. Dissert. Abstr.

N76-30910 Pennsylvania State Univ., University Park.
THE OPTICAL DEFORMATION POTENTIAL POLARON IN A UNIFORM MAGNETIC FIELD Ph.D. Thesis

James Henry Gray, III 1975 169 p
Avail: Univ. Microfilms Order No. 76-17170

An analysis is presented of the properties of the optical deformation potential polaron in a uniform magnetic field. In addition to the second order Rayleigh-Schrodinger (RS) perturbation theory, three other weak coupling theories were applied to this polaron. For each model, the energy-momentum relations were determined and a Green's function theory was employed to investigate quasiparticle properties. The analysis of the energy-momentum relations revealed certain unanticipated mathematical difficulties. First of all, it was discovered that a divergence occurred in the expression for the perturbed energy if the integration over phonon wavevector was extended beyond the Brillouin zone. Furthermore, unlike results for other polaron problems, the perturbed energy for large magnetic fields included a constant term due to the upper Landau levels, in addition to the usually predominant zeroth level contribution. However, a renormalization of the theory for this polaron problem led to a mathematical model for large magnetic fields that eliminated the above difficulties. Dissert. Abstr.

N76-30911*# Georgia Inst. of Tech., Atlanta.
PERMITTIVITY OF WATER AT MILLIMETER WAVELENGTHS
M. D. Blue Aug. 1976 39 p refs
(Grant NsG-5082)
(NASA-CR-148719) Avail: NTIS HC $4.00 CSCL 20F

Work performed on the permittivity of seawater and ice at 100 GHz was described. Measurements on water covered the temperature range from 0 to 50 C, while the measurements on ice were taken near - 10 C. In addition, a small number of measurements were made on the reflectivity of absorber materials used in a previous program on research in millimeter wave techniques. Normal incidence reflectivity was measured, and the result was used to obtain the index of refraction. For the case of normal incidence, reflectivity at a fixed temperature was reproducible to 1% for values near 40%. For reflectivity measurements on ice, the lack of attenuation leads to reflection from the back surface of the sample; this complication was circumvented by using a wedge shaped sample and freezing the water in a container lined with absorber material. Y.J.A.

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N76-30912 Washington Univ., Seattle.
ULTRASOUND APPLIED TO HEMATOLOGY Ph.D. Thesis
KoPing Kirk Shung 1975 178 p
Avail: Univ. Microfilms Order No. 76-17623

Necessary quantitative information is provided about the scattering properties of ultrasound in blood based on an experimental technique developed by Sigelmann and Reid. This is required for the improved design of the Doppler flow systems and a better understanding of the interaction of ultrasound and blood. Although primary effort was in blood, other biological tissues may be analyzed with similar technique. The ultrasonic volumetric scattering cross-section of the erythrocyte was investigated over a range of frequencies and pulse widths by comparing the rms value of the gated backscattered signal from blood cells with that of a wave reflected from a flat reflector with known reflection coefficient. It is found proportional to the fourth power of the frequency over the range of 5 MHz to 15 MHz and independent of the pulse width. Dissert. Abstr.

N76-30913 Pennsylvania State Univ., University Park.
ACOUSTIC RADIATION FROM PROLATE SPHEROIDAL LENSES Ph.D. Thesis
Frank M. Valenzuela 1975 117 p
Avail: Univ. Microfilms Order No. 76-18391

A mathematical analysis of the acoustic radiation from multiple prolate spheroidal surfaces is presented. It forms the basis for developing a better model to predict a submarine's sonar performance. The sonar array and its dome were modeled as a prolate spheroidal array confocal to a prolate spheroidal dome. The dome was represented by a mass only 0.25 inch thick steel shell, with a major axis equal to twice the length of the bow sonar cavity and a minor axis dimension typical for a submarine. The minor and the semimajor axis of the array were made equal to the spherical array's diameter. Four loading conditions were imposed on the array. The loading conditions were: (1) free field radiation, (2) acoustic lens, (3) mass loaded acoustic lens, and (4) mass loaded non-lens. The preceding problems were analyzed by superposition of spheroidal wave functions. Dissert. Abstr.

N76-30914 Pennsylvania State Univ., University Park.
AN EXPERIMENTAL INVESTIGATION OF THE WALL PRESSURE FLUCTUATIONS IN PIPING CONTAINING SIMPLE CONTROL DEVICES Ph.D. Thesis
Albertas Vidutis Karvelis 1975 273 p
Avail: Univ. Microfilms Order No. 76-18384

An experimental investigation of the wall pressure field characteristics associated with several control devices is reported. The investigation was conducted using a 3.01 inch inside diameter pipe containing several control/throttling devices using air as the working fluid and operating above critical pressure drop. Cross-correlations and narrow band spectrum levels were measured using several flush mounted wall pressure transducers located upstream and downstream of the devices. A theory is presented which relates the filtered cross covariance obtained from two wall pressure transducers to the true sound power generated by the device. This theory, which is based on the space-time correlation properties of one dimensional random acoustic fields, is verified by experiment. Dissert. Abstr.

N76-30915 Pennsylvania State Univ., University Park.
A THEORETICAL AND EXPERIMENTAL STUDY OF THE GENERATION AND REDUCTION OF MULTIPLE HIGHER-ORDER MODES IN A HARD-WALLED, ANECHOICALLY-TERMINATED CYLINDRICAL DUCT Ph.D. Thesis
Michael John Oslac 1975 197 p
Avail: Univ. Microfilms Order No. 76-18388

While significant strides have been made in the reduction of noise from turbo-machinery, fans/compressors, and from airmoving systems in general, there is still a need for ongoing fundamental research to optimize the performance of present technology and devise new methods of noise reduction. A method is presented whereby acoustic duct liners can be investigated in terms of their optimization and by developing the fundamentals for the active noise reduction technique of phased cancellation. The optimization of acoustic duct liners can be performed by utilization of the Spinning Mode Synthesizer (SMS) originally developed at The Pennsylvania State University's Noise Control Laboratory and expanded on, in terms of its application to in-duct testing, in this study. The SMS is a controllable device whereby single, multiple and/or combinations of higher order duct modes can be generated and propagated in cylindrical ducts. The results presented in this study show excellent agreement with theoretical predictions. Dissert. Abstr.

N76-30916 Connecticut Univ., Storrs.
TIME DELAY ESTIMATION Ph.D. Thesis
George Clifford Carter 1976 253 p
Avail: Univ. Microfilms Order No. 76-18986

Methodologies for passive estimation of the bearing to a slowly moving acoustically radiating source are investigated. The mathematics for the solution to such a problem is analogous to estimating the time delay (or group delay) between two time series. Techniques for estimation of time delay can be applied to a variety of practical problems. Because the estimation of time delay is intimately related to the coherence between two time series, an extensive investigation of coherence is presented. Results on using coherence to provide information about linear and nonlinear systems are presented and proved. The maximum likelihood estimate of time delay (under jointly stationary Gaussian assumptions) is derived. The explicit dependence of the time delay estimate on coherence is discussed. The hypothesized delay at which the generalized crosscorrelation (GCC) function peaks is the time delay estimate. From the GCC realization the variance of the time delay estimate is obtained. Dissert. Abstr.

N76-30917 Ohio State Univ., Columbus.
THE EFFECT OF AUDITORY FATIGUE ON DIFFERENCE LIMEN FOR FREQUENCY Ph.D. Thesis
Carol Anne Watson 1976 158 p refs
Avail: Univ. Microfilms Order No. 76-18056

In order to study the effects of exposure to intense auditory stimuli on difference limen for frequency, thirty subjects were exposed to tones of 250 Hz and 4,000 Hz in separate experiments, and asked to provide dlf measures at 3 test frequencies following the exposures in 3 separate parts of each experiment. Test frequencies included 180, 250, and 350 Hz for the 250 Hz exposure tone, and 2800, 4000, and 5600 Hz for the 4000 Hz exposure tone. Following the exposure the subject made pitch judgements by adjusting a variable tone to be 'just higher' or 'just lower' than the standard tone. Also during the post-exposure test period threshold estimates were obtained by the subject bracketing the presence or absence of a pulsed tone. Both pre exposure and control data were collected for threshold estimates and pitch-difference judgements for all conditions. An analysis of the data was then performed using 3 separate ANOVA designs for various parts of the experiment. Detailed results are presented and discussed. Dissert. Abstr.

N76-30918 New South Wales Univ., Kensington (Australia).
DEVICE APPLICATIONS OF SURFACE ACOUSTIC WAVES Ph.D. Thesis
Sitthichai Pookaiyaudom 1976 291 p
Avail: Univ. Microfilms Order No. 76-18734

The propagation of both unguided and guided surface acoustic waves is discussed. A brief but complete outline is given of the classical method of solution of surface acoustic wave problems in general homogenous piezoelectric substrates. The analytical method appropriate to surface waves in layered media is briefly outlined. The analysis of novel radial Love waves is given, including the conditions for perfect reflection. Miscellaneous techniques and devices are also considered. The basic existing methods of surface acoustic wave transduction are reviewed, followed by description and experimental results of a new method of surface acoustic wave transduction in nonpiezoelectric substrates. An interdigital transducer layout is described for measurements of propagation and transmission losses of surface acoustic wave in wrap-around delay line structures. Dissert. Abstr.

N76-30919*# Virginia Univ., Charlottesville. School of Engineering and Applied Science.
USE OF STEEPEST DESCENT AND VARIOUS APPROXIMATIONS FOR EFFICIENT COMPUTATION OF MINIMUM NOISE AIRCRAFT LANDING TRAJECTORIES Annual Report
G. Cook and R. M. Witt Aug. 1976 85 p refs
(Contract NsG-1101)
(NASA-CR-148718; UVA/528075/EE76/103) Avail: NTIS HC $5.00 CSCL 20A

The following areas related to landing trajectory optimization research were discussed: (1) programming and modifying the steepest descent optimization procedure, (2) successfully iterating toward the optimum for a four-mile trajectory, (3) beginning optimization runs for a twenty-mile trajectory, and (4) adapt wind tunnel data for computer usage. Other related areas were discussed in detail in the two previous annual reports. Author

N76-30920*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPLICATIONS OF THE ULTRASONIC SERIAL NUMBER RESTORATION TECHNIQUE TO GUNS AND TYPICAL STOLEN ARTICLES
S. G. Young Jul. 1976 21 p refs
(NASA-TM-X-73452; E-8811) Avail: NTIS HC $3.50 CSCL 20A

An ultrasonic cavitation method for restoring obliterated serial numbers has been further explored by application to articles involved in police cases. The method was applied successfully to gun parts. In one case portions of numbers were restored after prior failure by other laboratories using chemical etching techniques. The ultrasonic method was not successful on a heavily obliterated and restamped automobile engine block, but it was partially successful on a motorcycle gear-case housing. Additional studies were made on the effect of a larger diameter ultrasonic probe, and on the method's ability to restore numbers obliterated by peening. Author

N76-30921*# Flow Research, Inc., Kent, Wash.
NUMERICAL SIMULATION OF TURBULENT JET NOISE, PART 2
Ralph W. Metcalfe and Steven A. Orszag Feb. 1976 25 p refs
(Contract NAS1-12870)
(NASA-CR-144978; Rept-62-Pt-2) Avail: NTIS HC $3.50 CSCL 20A

Results on the numerical simulation of jet flow fields were used to study the radiated sound field, and in addition, to extend and test the capabilities of the turbulent jet simulation codes. The principal result of the investigation was the computation of the radiated sound field from a turbulent jet. In addition, the computer codes were extended to account for the effects of compressibility and eddy viscosity, and the treatment of the nonlinear terms of the Navier-Stokes equations was modified so that they can be computed in a semi-implicit way. A summary of the flow model and a description of the numerical methods used for its solution are presented. Calculations of the radiated sound field are reported. In addition, the extensions that were made to the fundamental dynamical codes are described. Finally, the current state-of-the-art for computer simulation of turbulent jet noise is summarized. Author

N76-30922*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NOISE GENERATED BY IMPINGEMENT OF TURBULENT FLOW ON AIRFOILS OF VARIED CHORD, CYLINDERS, AND OTHER FLOW OBSTRUCTIONS
W. A. Olsen 1976 36 p refs Presented at the 3d Aero-Acoustic Conf., Palo Alto, Calif., 20-22 Jul. 1976; sponsored by AIAA
(NASA-TM-X-73464; E-8829; AIAA-Paper-76-504) Avail: NTIS HC $4.00 CSCL 20A

Noise spectra were measured in three dimensions for several surfaces immersed in turbulent flow from a jet and over a range of flow conditions. The data are free field and were corrected to remove the small contributions of jet noise, atmospheric attenuation and feedback tones. These broadband data were compared with the results of available theories which are only strictly applicable to simple geometries over a limited range of conditions. The available theories proved to be accurate over the range of flow, chord length, thickness, angle of attack, and surface geometries defined by the experiments. These results apply to the noise generated by fixed surfaces in engine passages, the lifting surfaces of aircraft and also to fan noise. Author

N76-30923*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CONCORDE NOISE-INDUCED BUILDING VIBRATIONS, MONTGOMERY COUNTY, MARYLAND
W. H. Mayes, H. F. Scholl, D. G. Stephens, B. G. Holliday, R. DeLoach, T. D. Finley, H. K. Holmes, R. B. Lewis, and J. W. Lynch Aug. 1976 43 p refs
(NASA-TM-X-73947; Rept-3) Avail: NTIS HC $4.00 CSCL 13M

A series of studies are reported to assess the noise induced building vibrations associated with Concorde operations. The levels of induced vibration and associated indoor/outdoor noise levels resulting from aircraft and nonaircraft events in selected homes, historic and other buildings near Dulles International Airport were recorded. The building response resulting from aircraft operations was found to be directly proportional to the overall sound pressure level and approximately independent of the aircraft type. The noise levels and, consequently, the response levels were observed to be higher for the Concorde operations than for the CTOL operations. Furthermore, the vibration could be closely reproduced by playing aircraft noise through a loudspeaker system located near the vibration measurement location. Nonaircraft events such as door closing were again observed to result in higher response levels than those induced by aircraft. Author

N76-30924*# Purdue Univ., Lafayette, Ind. School of Aeronautics and Astronautics.
NONCLASSICAL ACOUSTICS
Czeslaw P. Kentzer 23 Aug. 1976 27 p refs Presented at

7th Intern. Symp. on Nonlinear Acoustics, Blacksburg, Va., 19-21 Aug. 1976
(Grant NsG-1293)
(NASA-CR-145071; Rept-76-1) Avail: NTIS HC $4.00 CSCL 20A

A statistical approach to sound propagation is considered in situations where, due to the presence of large gradients of properties of the medium, the classical (deterministic) treatment of wave motion is inadequate. Mathematical methods for wave motions not restricted to small wavelengths (analogous to known methods of quantum mechanics) are used to formulate a wave theory of sound in nonuniform flows. Nonlinear transport equations for field probabilities are derived for the limiting case of noninteracting sound waves and it is postulated that such transport equations, appropriately generalized, may be used to predict the statistical behavior of sound in arbitrary flows.Author

N76-30925# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany). Inst. fuer Turbulenzforschung.
AN EXPERIMENTAL INVESTIGATION ON NOISE PRODUCTION AND NOISE PROPAGATION IN CENTRIFUGAL FANS
Manfred Bartenwerfer, Reuben Agnon, and Theofani Gikadi 10 Feb. 1976 57 p refs In GERMAN; ENGLISH summary Prepared jointly with Tech. Univ., Berlin
(DLR-FB-76-14) Avail: NTIS HC $4.50; DFVLR, Cologne DM 21,40

The harmonic part of the noise of a model fan as well as the random component were measured at three different locations (inlet duct, outlet duct, and at the cutoff) for a tip speed range between 15 to 60 m/s and for a few representative points of the pressure-head volume-flow characteristic. It is shown that the harmonic and the random noise components follow a generalized form of the similarity law introduced by Weidemann. But the physical interpretation of the spectral distribution function and the frequency response function in Weidemann's expression is complicated by the fact that both functions depend on the measuring point and the operating conditions of the fan. A well known power law seems to be inadequate to describe either the total sound pressure or that of individual noise components because the tip speed exponent, too, depends on measuring point and operating conditions. Author (ESA)

N76-30926# Institut Franco-Allemand de Recherches, St. Louis (France).
JET NOISE RESEARCH BY MEANS OF SHOCK TUBES
H. Oertel 2 Jul. 1975 12 p refs Presented at the 10th Intern. Shock Tube Symp., Kyoto, 14-17 Jul. 1975
(ISL-CO-209/75) Avail: NTIS HC $3.50

A high pressure shock tube was used for studying the wave angles of straight waves emitted from cold and hot supersonic free jets. Difficulties encountered with turbulence hiding the waves were overcome by means of new visualization techniques. A simple relation was found between wave angle, jet Mach number, and sound velocity ratio which agrees well with a theoretical model. Author (ESA)

N76-30927# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CONVECTION AND REFRACTION EFFECTS OF AN ACOUSTIC WAVE IN A FLOW Ph.D. Thesis - Paris Univ., 1975
Jacques Randon Feb. 1976 61 p refs In FRENCH; ENGLISH summary Report will also be announced as translation
(ONERA-NT-1975-2) Avail: NTIS HC $4.50

Refraction effects due to flow velocity and temperature were surveyed and applied to the atmospheric propagation of acoustic waves and to the propagation of acoustic waves in a hot jet of finite radial dimension. The two-dimensional trajectories of acoustic rays were calculated numerically using the mean temperatures and velocities measured in the jet to predict the acoustic radiation of a hot jet. ESA

N76-30928# National Bureau of Standards, Washington, D.C. Mechanics Div.
A MINICOMPUTER-BASED SYSTEM FOR THE MEASUREMENT AND ANALYSIS OF COMMUNITY NOISE Final Report, May 1974 - Feb. 1975
R. L. Fisher, D. S. Blomquist, J. S. Forrer, and D. M. Corley Apr. 1975 106 p Sponsored by the US Army Environmental Hygiene Agency
(PB-250385/2; NBSIR-75-692) Avail: NTIS HC $5.50 CSCL 20A

An operating system for the measurement and analysis of community noise was turned over to the Army for their use in February 1975, thus accomplishing the transfer of technology developed by NBS to the Bioacoustics Division, U.S. Army Environmental Hygiene Agency. This report documents the hardware and software packages prepared by NBS in support of this system. The documentation includes: explanation of the hardware and its interaction with the software; block diagrams to aid understanding of the system and facilitate any future system modifications; sample calculations for testing and diagnostics; and user instructions. GRA

N76-30929# National Bureau of Standards, Washington, D.C.
STANDARDS ON NOISE MEASUREMENTS, RATING SCHEMES, AND DEFINITIONS: A COMPILATION
Thomas L. Quindry, ed. Apr. 1976 88 p Supersedes COM-73-50985
(PB-251330/7; NBS-SP-386; LC-73-600305; COM-73-50985) Avail: NTIS HC $5.00 CSCL 20A

The compilation deals with material assembled from the various standards, industrial and trade organizations, or technical and scientific societies concerned with acoustics. The paragraphs describing the standards give a brief summary of intent and/or scope of the standard. In some cases the paragraph is the official description of the standard as issued by the organization or society promulgating the standard, while in others the paragraph merely describes the intent of the standard. Proposed standards are also listed where available. Not listed are proposed revisions of current standards and those which must be reapproved to remain in effect. For the convenience of those readers wishing to purchase copies of standards, names and addresses for the various organizations and/or societies are provided. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N76-30930 Kansas Univ., Kansas City.
INVESTIGATION OF THE PARTICLE DECAY PROPERTIES OF RESONANCE STATES IN Mg-24 AND INVESTIGATION OF THE GAMMA-RAY DECAY PROPERTIES OF THE 13.39 MeV STATE IN N-15 Ph.D. Thesis
Donald Gene Shirk 1975 124 p
Avail: Univ. Microfilms Order No. 76-16780

The structure of nuclear levels in Mg-24 was examined by various reactions involving a Na-23 target and a proton beam. There were three goals for the present experiment: first, to determine the dominance of the compound nucleus formation in a qualitative way in the range of 13 to 15 MeV excitation energy; second, to confirm or determine consistent spin and parity assignments for states in this energy region; and third, to establish when possible the total isospin of particular states. From examination of the various differential cross section curves, it was found by the presence of many narrow isolated resonances that the compound nucleus formation is the dominant process in the energy studied. A total of thirty-three resonances were studied in the present work using the Blatt and Biedenharn formalism. Firm spin and parity assignments were made or confirmed for twenty of these resonances. Excitation energies, total widths, reduced proton, and alpha widths (where applicable) were determined. Dissert. Abstr.

N76-30931 Ohio Univ., Athens.
A STUDY OF TRANSFER REACTIONS BY MEANS OF THE COUPLED CHANNELS BORN APPROXIMATION WITH EXACT FINITE RANGE AND RECOIL Ph.D. Thesis
Pierre Bernard Nagel 1976 195 p
Avail: Univ. Microfilms Order No. 76-18449

The formalism for the finite range coupled channels Born approximation (FRCCBA) is derived for the purpose of extending present day direct reaction calculations. This is required in order to meaningfully analyze heavy ion transfer reactions in which both finite range effects and multistep processes take place. The formalism was derived by making use of the plane wave expansion method. This procedure allowed the six-dimensional integrals of the transition amplitude matrix to be factored into a product of two one-dimensional integrals. The computer code OUKID was developed to implement the FRCCBA formalism. The code was then used to analyze both light ion and heavy ion reactions. The results of the analyses confirm that multistep processes are in general present in heavy ion transfer reactions.
Dissert. Abstr.

N76-30932 Arizona Univ., Phoenix.
ELASTIC AND INELASTIC CHARGE FORM FACTORS FOR 3Li-6 FROM ELECTRON SCATTERING Ph.D. Thesis
Gerald Lewis Payne 1976 136 p
Avail: Univ. Microfilms Order No. 76-18588

The two body interaction is investigated that a nucleon experiences inside the nucleus. A model was used that assumed that the core nucleons move in a harmonic oscillator well. The valence nucleons were assumed to move in a harmonic oscillator well and to interact with each other. Harmonic oscillator frequency, hard core radius, and Gaussian parameters were determined and used to calculate the corresponding nuclear wave functions for the ground and first excited states of 3Li-6. Using these wave functions, the elastic and inelastic charge form factors were determined from 3Li-6 electron scattering. Theoretical form factors were compared with experimental data. Dissert. Abstr.

N76-30933 Lowell Technological Univ., Mass.
AN INVARIANT IMBEDDING ANALYSIS OF PARTICLE TRANSPORT INCORPORATING ORDERS-OF-SCATTERING Ph.D. Thesis
Stanley Woolf 1976 213 p
Avail: Univ. Microfilms Order No. 76-16863

A method for calculating emergent n-th scattered particle currents from scattering media is developed which combines an orders-of-scattering formulation with the invariant imbedding method. The final expressions obtained for these currents assume the form of coupled integral recursion relations expressing the interdependence of the currents of the various scattering orders. Numerical results are presented, along with their comparisons obtained by other techniques, arising from the implementation of these recursion relations. Various cases of neutron and electron scattering, both isotropic and anisotropic, are considered.
Dissert. Abstr.

N76-30934 Michigan State Univ., East Lansing.
PHYSICS, ELEMENTARY PARTICLES AND HIGH ENERGY. DEEP INELASTIC MUON SCATTERING AT 150 AND 56.3 GeV Ph.D. Thesis
Chuen Chang 1976 182 p
Avail: Univ. Microfilms Order No. 76-18606

Data of deep inelastic muon scattering are collected with muons of 150 and 56.3 GeV to test Bjorken scaling. Heavy targets (mainly iron) were used in the experiment, so that events with q squared (four momentum transfer square) up to 80 (GeV/c) squared or scaling variable up to 40 were possible. Up to 31 inch long iron core magnets were used as momentum analyzers. The detection consisted of plastic scintillation counters, proportional chambers, and on-line computer. In the SLAC region, the data agreed well with SLAC's, confirming muon-electron universality. Outside of the SLAC region deviations from Bjorken scaling were observed. The two photon exchange contribution was estimated by comparing positive muon data to negative muon data.
Dissert. Abstr.

N76-30935 Cornell Univ., Ithaca, N.Y.
THE OVERLAP SLOPE AND TWO-PARTICLE CORRELATIONS FOR A MULTIPERIPHERAL MODEL WITH MULTI-LINK INTERACTIONS IN IMPACT PARAMETER Ph.D. Thesis
Dennis Ray Molodowitch 1976 310 p
Avail: Univ. Microfilms Order No. 76-18172

Multiperipheral models for multiparticle production in inelastic proton collisions have had difficulty reconciling the observed transverse momentum cutoff with the observed t slope of the elastic peak, calculated via unitarity. Investigated were sources and possible solutions for this problem in terms of the impact parameter structure of the production process. This leads to a recognition of the importance of introducing multi-link interactions in impact parameter. The impact parameter amplitude for multiple production is modeled with a simple Ansatz that generalizes the random walk model to include longer range interactions. These are two major consequences of the introduction of these interactions: An end-effect is created, in that impact parameter steps near the ends of the multiperipheral chain are larger and more strongly correlated than are those in the center. This gives rise to a non-shrinking term to fit the magnitude of the elastic slope, and cohesive correlations are introduced to fit the shrinkage of the elastic slope. Dissert. Abstr.

N76-30936 Washington Univ., Seattle.
VACUUM POLARIZATION IN HEAVY MUONIC ATOMS Ph.D. Thesis
Larry Dean McLerran 1975 208 p
Avail: Univ. Microfilms Order No. 76-17562

Heavy muonic atoms are described and discussed. Certain experimentally accessible energy levels in these atoms are shown to provide excellent tests of quantum electrodynamics for moderately strong electrostatic fields. Vacuum polarization is shown to be the largest perturbation on these energy levels. The effect of vacuum polarization was calculated to all orders in the strength of the electrostatic field by making a short distance expansion appropriate to the energy levels of interest. Moreover, all other perturbations were estimated, and, where possible, calculated to an accuracy of better than the current experimental accuracy. Dissert. Abstr.

N76-30937 Ohio State Univ., Columbus.
ANALYZING POWER MEASUREMENTS FOR p + Ti-50 SCATTERING BELOW Ep = 4.75 MeV Ph.D. Thesis
John LaVerne Regner 1976 163 p
Avail: Univ. Mcrofilms Order No. 76-18030

Analyzing powers and relative cross sections for p- Ti-50 were measured for E sub p from 3.4 to 4.75 MeV at 130 deg, 140 deg, 150 deg and 160 deg sub lab. Analyzing power and cross section data were also obtained at the same angles for protons inelastically scattered to the first excited state of Ti -50 near E sub p =3.6 MeV and between E sub p = 4.25 and 4.75 MeV. The measurements were made utilizing a polarized ion source in conjunction with a Van de Graaff accelerator. The proton beam polarization was monitored with a He -4 polarimeter. Typically, the beam polarization was 0.65 with a beam intensity of 40 na. Using a technique for analyzing power measurements, data was taken in a rotatable scattering chamber. Chamber rotation of 180 deg about the beam axis effected a proper spin-flip for detector normalization. Dissert. Abstr.

N76-30938 Pennsylvania State Univ., University Park.
PHOTON CORRELATION SPECTROSCOPY Ph.D. Thesis
Eugenio Go Varona 1975 103 p
Avail: Univ. Microfilms Order No. 76-17237

A photon correlation spectrometer was constructed and applied to the study of two problems: (1) observation of quantum beats among the Zeeman levels in the P(-3)1 state of mercury; and (2) laser light scattering study of the helix-coil transformation in poly-L-glutamic acid. In atomic mercury, beats arising from the interference among the Zeeman levels in the P(-3)1 state were detected. In the laser light scattering study of the helix-coil transformation of poly-L-glutamic acid, two decay rates were observed; a slow one due to translational diffusion and a fast decay rate which is being attributed to the relaxation due to the helix-coil interconversion process. Dissert. Abstr.

N76-30939 Brandeis Univ., Waltham, Mass.
EFFECTS OF WAVEFUNCTION TYPE AND MULTIPLE SCATTERING ON THE COMPARISON OF CALCULATED AND EXPERIMENTAL COMPTON PROFILES Ph.D. Thesis
Anthony Charles Tanner 1976 290 p
Avail: Univ. Microfilms Order No. 76-16942

Calculated Compton profiles are shown to be sensitive to the choice of wavefunction type; both the size (from minimum

to near Hartree-Fock) and type (Slater and Gaussian, single center and multicenter) of basis set are examined. Deciding which of several calculated profiles is most accurate requires comparison with experimental profiles. It is then shown that experimental profiles cannot be used indiscriminately as criteria for assessing the accuracy of calculated profiles. The contribution of multiple scattering to the experimental profiles is shown to be significant in many cases. Thus the experimental profile is not necessarily the true Compton profile and can lead to erroneous decisions regarding the accuracy of calculated profiles. A general theoretical investigation of multiple scattering is undertaken using both analytic and Monte Carlo (numerical) calculations. Some of the current methods of correcting experimental profiles are reviewed and two more possible methods are suggested. Dissert. Abstr.

N76-30940# State Univ. of New York, Binghamton. Dept. of Physics.
NEUTRINO PHYSICS: NEW FLAVORS? OR CHARM, THEN COLOR, EXCITATION?
C. A. Nelson 31 Jul. 1976 33 p refs
Avail: NTIS HC $4.00

Investigation of charm, then color, excitation thru right-handed, color-octet currents is suggested as a more economical way than adding new flavors for avoiding the conflict of the Weinberg-Salam model with present data. The effects from simply adding to the GIM current, a new right handed color octet weak current (the analogue of the usual Cabibbo current) are calculated and compared with available charged current and neutral current data. Author

N76-30941# West Virginia Univ., Morgantown.
EXCITED STATE POTENTIAL ESTIMATES FOR ALKALI-NOBLE GAS PAIRS BASED ON BOTH LINE SHAPE AND PSEUDOPOTENTIAL CONSIDERATIONS: APPLICATION TO CsXe Ph.D. Thesis
Walter Leon Snow 1976 193 p refs
Avail: NTIS HC $7.50

Two independent schemes for approximating ground and excited states interatomic potentials were discussed: a simple quasistatic line shape theory applicable to wing data which may be used in conjunction with quantitative spectral measurements to infer emitter-perturber difference potentials, and an approximate quantum mechanical treatment. In the first approach, the line shape is first carefully related to experimental variables both to provide a pragmatic experimental definition and to underscore radiative transfer effects which tend to mask the useful information. A detailed calculation is done to examine why the discrete band structure usually associated with molecular transitions is subdued. Next, a nonlinear least squared method is described for estimating a difference potential consistent with the model and the observations. In the second approach, the concept of a pseudopotential is invoked to treat the alkali-perturber as a one electron molecule. Y.J.A.

N76-30942# Wisconsin Univ., Milwaukee.
STUDY OF ELECTRON AND UV PHOTON SURFACE INTERACTIONS Progress Report, 1 Mar. 1975 - 28 Feb. 1976
D. Lichtman Nov. 1975 10 p refs
(Contract AT(11-1)-2425)
(C... -2425-3) Avail: NTIS HC $3.50

Investigations are reported on electron induced desorption, the photodesorption process, and the development of a critical review on both electron and photon induced desorption, especially as they relate to the controlled thermonuclear research program. Author (NSA)

N76-30943# Argonne National Lab., Ill.
DEFECT PRODUCTION BY ENERGETIC PARTICLE BOMBARDMENT
K. L. Merkle 1976 37 p refs Presented at Materials Science Seminar, Cincinnati, 9-10 Nov. 1975; sponsored by Am. Soc. of Metals
(Contract W-31-109-eng-38)
(CONF-751164-2) Avail: NTIS HC $4.00

Aspects of low dose, low temperature irradiation experiments, and elevated temperature experiments are reviewed. Information and data are included on methods of determining lattice atom displacement thresholds, lattice damage rates measured by changes in resistivity, ion damage, and neutron damage. Author (NSA)

N76-30944# Bergen Univ. (Norway). Dept. of Physics.
CURRENT IDEAS ON ION-ATOM COLLISIONS
J. M. Hansteen Aug. 1975 50 p refs Presented at the Annual Meeting of the Norwegian Physical Society, Bergen, 18-20 Jun. 1975
(BUP-79; Conf-7506108-1) Avail: ERDA Depository Libraries HC $4.00

A survey is given of recent developments in the understanding of ion-atom collisions, with particular emphasis on processes leading to ion-induced X-rays. The inner-shell Coulomb ionization phenomena are discussed at some length, with stress on the near-quantitative picture that appears to emerge from simple-minded models. The phenomenon of Pauli excitations and the formation of quasi-molecules leading to united atom phenomena are qualitatively reviewed together with a brief mention of target recoil effects and electron capture processes. Selected background phenomena of importance in interpreting experiments are touched upon, such as various types of bremsstrahlung production. Implications of the recently-discovered interplay between Coulomb-induced processes and united atom phenomena are especially mentioned. It is suggested that this branch of collision physics is reaching a point where new notions and more advanced and unifying models are greatly needed. Author (NSA)

N76-30945# Wisconsin Univ., Madison. Dept. of Nuclear Engineering.
INELASTIC MOLECULAR COLLISIONS: APPLICATION OF THEORETICAL METHODS TO PROBLEMS RELEVANT TO LASER OPERATION Progress Report, 1 Feb. - 1 Nov. 1975
1975 14 p refs
(Contract AT(11-1)-2555)
(TID-26983) Avail: NTIS HC $4.50

Information is presented on the decomposition theory of molecular collisions for non-reactive and reactive scattering. The basic theoretical problem of calculating molecular collision phenomena is discussed. Research done in these areas from Feb. 1, 1975 to Nov. 1, 1975, is described. NSA

N76-30946# IRT Corp., San Diego, Calif.
ENERGY DISTRIBUTIONS OF SECONDARY ELECTRONS FROM Ar, N2, H2O, AN H2O WITH CLUSTERS PRESENT
R. F. Mathis and D. A. Vroom 1975 15 p refs Sponsored by ERDA
(SAN-936X10) Avail: NTIS HC $3.50

Crossed beam measurements were made of the energy spectra of secondary electrons resulting from collisions of 1 keV primary electrons with N2, Ar, H2O, and H2O with clusters present. Only those electrons emitted normal to the primary beams were detected. A through description of the apparatus is given. Author (NSA)

N76-30947# Washington Univ., Seattle. Dept. of Physics.
RE-ORIENTATION SPECTROSCOPY OF STORED IONS Final Report, May 1969 - May 1974
Hans G. Dehmelt Sep. 1975 48 p
(Contract N00014-67-A-0103-0009; NR Proj. 014-307)
(AD-A020146) Avail: NTIS CSCL 07/4

The results of a program of research in the rf spectroscopy of stored ions are described. Work has been done on the study of magnetic resonance and hfs of e(-), and H2(+). Techniques for measuring the temperature of ion gases and their radiative cooling have been developed. Continuous observation of a single electron oscillating with an energy of approximately (1/100)eV inside a penning trap has been realized, 'Monoelectron Oscillator'. A new principle of forced radial shrinking of stored ion clouds by simulataneous cyclotron excitation and axial damping has been proposed which may be of use in the confinement of fusion plasmas. GRA

N76-30948# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
COMPARISON OF THEORETICAL AND EXPERIMENTAL PHOTOEFFECT DATA 0.1 keV TO 1.5 MeV

J. H. Hubbell and William J. Veigele Apr. 1976 46 p refs Sponsored in part by DNA, Washington, D. C.
(PB-251269/7; NBS-TN-901) Avail: NTIS HC $4.00 CSCL 07D

Graphs of calculated and experimental atomic photo-effect cross section as a function of photon energy 0.1 keV to 1.5 MeV are presented for all elements Z = 1 to 94. The calculated results presented are (a) the nonrelativistic Hartree-Fock self-consistent-field (SCF) results of Veigele, Henry, et al., over the range 0.1 keV to between 1.9 and 8.0 keV for all elements Z = 1 to 94 and (b) the relativistic Hartree-Slater SCF results of Scofield over the range 1.0 keV to 1.5 MeV for all elements Z = 1 to 101. The experimental data-points are derived by subtracting theoretical scattering cross sections from total attenuation coefficient measurements in the literature. GRA

N76-30949# National Bureau of Standards, Boulder, Colo.
CROSS-SECTION MEASUREMENTS FOR ELECTRON-H3O(+) RECOMBINATION Final Report
R. A. Heppner, F. L. Walls, W. T. Armstrong, and G. H. Dunn 2 Sep. 1975 13 p refs
(Grant NSF GP-35065)
(PB-252434/6) Avail: NTIS HC $3.50 CSCL 07D

Cross sections for electron-H3O recombination were measured over an electron energy range of .050 eV to 1.15 eV by using a trapped ion technique. Recombination rate coefficients were calculated from the deduced cross section by assuming a Maxwellian electron velocity distribution. GRA

N76-30950# National Bureau of Standards, Boulder, Colo.
EXCITATION OF THE Sr AND Sr(+) RESONANCE LINES BY ELECTRON IMPACT ON Sr ATOMS
S. T. Chen, D. Leep, and A. Gallagher 11 Nov. 1975 7 p refs Repr. from Phys. Rev. A, v. 13, no. 3, Mar. 1976 p 947-952 Prepared in cooperation with Joint Inst. for Lab. Astrophys.
(Grant NSF GP-39308)
(PB-252435/3) Avail: NTIS HC $3.50 CSCL 07D

The relative optical excitation functions and polarizations of the Sr resonance lines (4607 A) and of the Sr(+) resonance line (4078 A and 4216 A) have been measured, using crossed electron and strontium atom beams, for electron energies from the excitation thresholds to 1497 eV. The excitation functions of the ionic lines were measured relative to that of the atomic resonance line at fixed energies near the maxima of the excitation functions. Using spontaneous emission branching ratios, this yields the ratios of total excitation cross sections for the atomic and ionic resonance levels (including cascades). GRA.

N76-30951# Kansas State Univ., Manhattan. Dept. of Nuclear Engineering.
A COHESIVE STUDY OF ELECTRONIC MATERIALS AND COMPONENTS IN NUCLEAR-RADIATION ENVIRONMENTS Final Report, 15 Jun. 1968 - 31 Aug. 1974
Herman J. Donnert 20 Jan. 1976 44 p refs
(Contract N00014-68-A-0504)
(AD-A023279) Avail: NTIS CSCL 18/6

This report summarizes the accomplishments of a team of investigators engaged in a coordinated and cohesive study of electronic materials and components in nuclear-radiation environments and, concomitantly, of germane techniques for characterizing such radiation environments. GRA

N76-30952# Pittsburgh Univ., Pa. Space Research Coordination Center.
SYMMETRIC CHARGE TRANSFER IN LOW-ENERGY ION-ATOM COLLISIONS
Swati Sinha and J. N. Bardsley 9 Feb. 1975 40 p refs
(Contracts N00014-76-C-0098; E(04-3)-1106; ARPA Order 2686)
(AD-A022428; SRCC-218) Avail: NTIS CSCL 07/4

Previous calculations of ion-atom interactions by the pseudopotential and asymptotic methods are used in the computation of the cross section for symmetric charge transfer at energies below 1 keV. The results for Li(+), Na(+), K(+), Rb(+), Cs(+) and Ca(+) ions are compared with data obtained in beam experiments, and by optical pumping techniques. The difference in the cross sections for doublet P(1/2) and doublet P(3/2) ions of Kr(+) and Xe(+) at thermal energies is studied and the predictions are compared with recent mobility measurements. Cross sections are obtained for U(+) - U collisions, and the dependence of the thermal cross section on the polarizability is described. Symmetric charge transfer of the negative ions H(-), Na(-) and Cs(-) is discussed briefly. GRA

N76-30953# Aerospace Corp., El Segundo, Calif.
THEORETICAL DESCRIPTION OF THE DOUBLET A'' AND DOUBLET A' STATES OF THE PEROXYFORMYL RADICAL Interim Report
Nicholas W. Winter, William A. Goddard, III (Calif. Inst. of Technol., Pasadena), and Charles F. Bender (Calif. Univ., Livermore. Lawrence Livermore Lab.) 30 Jan. 1976 25 p refs
(Contract F04701-75-C-0076; Grant NSF GP-40783)
(AD-A021067; TR-0076(6970)-2; SAMSO-TR-76-27) Avail: NTIS CSCL 07/4

The authors use simple orbital ideas to describe the lowest two (doublet A'' and doublet A') of the peroxyformyl radical and report ab initio Hartree-Fock calculations for these states. It was found that both states may be formed exothermically by association of O2 and HCO in their ground states; however, the excited state may decompose readily to OH and CO2. The possible role of such processes in oxidation of aldehydes is discussed. GRA

N76-30954# Office of Naval Research, London (England).
RELAXATION PROCESSES IN MAGNETIC SYSTEMS
Thomas A. Kitchens 30 Dec. 1975 7 p
(AD-A020436; ONRL-C-21-75) Avail: NTIS CSCL 07/4

The British Radio-Spectroscopy Group met at the University of Bristol 3-4 September, 1975, to discuss relaxation in magnetic systems, a historical review of early experiments pertaining to 'spin' of electrons and nuclei by Dr. E. E. Schneider of Newcastle upon Tyne. Thirteen talks were given on relaxation effects in magnetic systems investigated by nuclear magnetic and electron spin resonance techniques. GRA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N76-30955 Maryland Univ., College Park.
COLLECTIVE EFFECTS IN THE FORMATION AND ACCELERATION OF ELECTRON RINGS Ph.D. Thesis
Anton Carl Greenwald 1975 200 p
Avail: Univ. Microfilms Order No. 76-17798

Dense hollow rotating relativistic electron beams are studied that are used for accelerating ions in an electron ring accelerator. Considered is the problem of forming a ring by axial compression of a long beam in a static magnetic field. The second section assumes that an electron ring has been formed and loaded with ions. An analysis is then made of the nonequilibrium processes of moving the ion loaded ring out of a magnetic mirror and accelerating it in an expanding magnetic field. Dissert. Abstr.

N76-30956 Cornell Univ., Ithaca, N.Y.
PHOTOPRODUCTION OF THE OMEGA (3095) ON NUCLEAR TARGETS Ph.D. Thesis
David Lester Nease 1976 96 p
Avail: Univ. Microfilms Order No. 76-18177

A very narrow resonance, the psi (3095), has been observed in the dimuon mass spectrum of the reactions: photon + Be yields positive muon + negative muon + anything, and photon + Pb yields positive muon + negative muon + anything. This photoproduction experiment was carried out in a wide band photon beam. Useful photon energies for these reactions were from 50-210 GeV. Final state particles were detected in a magnetic spectrometer and particle identifier. The particle identifier included a segmented electron and photon calorimeter, a hadron calorimeter, and a muon identifier. One hundred and two events of the type psi (3095) yields positive muon negative muon were observed

from the Be target and twelve events from the Pb target. The photoproduction peaks from the duced psi's from the Be target exhibited a prominent coherent peak characteristic of the Be nucleus. Dissert. Abstr.

N76-30957*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ION BEAM TEXTURING
Wayne R. Hudson 1976 14 p refs Presented at 23d Vacuum Symp., Chicago, 21-24 Sep. 1976; sponsored by Am. Vacuum Soc.
(NASA-TM-X-73470; E-8853) Avail: NTIS HC $3.50 CSCL 20J

A microscopic surface texture is created by sputter etching a surface while simultaneously sputter depositing a lower sputter yield material onto the surface. A xenon ion beam source has been used to perform this texturing process on samples as large as three centimeters in diameter. Ion beam textured surface structures have been characterized with SEM photomicrographs for a large number of materials including Cu, Al, Si, Ti, Ni, Fe, Stainless steel, Au, and Ag. Surfaces have been textured using a variety of low sputter yield materials - Ta, Mo, Nb, and Ti. The initial stages of the texture creation have been documented, and the technique of ion beam sputter removal of any remaining deposited material has been studied. A number of other texturing parameters have been studied such as the variation of the texture with ion beam power, surface temperature, and the rate of texture growth with sputter etching time. Author

N76-30958# Intelcom Rad Tech, San Diego, Calif.
INTEGRAL MEASUREMENTS TO TEST NEUTRON SCATTERING AND GAMMA-RAY PRODUCTION CROSS SECTIONS FOR Be, C, N, H2O, AND Fe Final Report, Aug. 1971 - May 1975
L. Harris, Jr., J. C. Young, D. E. Bryan, N. A. Lurie, and D. K. Steinman 2 Jun. 1975 302 p refs
(Contract DNA001-72-C-0020; DNA Proj. NWED-QAXPE075) (AD-A022196; INTEL-RT-8013-006; DNA-3754F) Avail: NTIS CSCL 20/8

Incident-neutron-energy-dependent measurements of scattered neutrons and secondary gamma rays for small samples of Be, C, N, H2O, and Fe have been performed at four scattering angles (30, 55, 90 and 125 degrees). The pulsed-white-neutron source, time-of-flight (TOF) method, and NE-213 detector with pulse-shape discrimination, three-parameter data acquisition with an online computer and spectrum unfolding were used to measure incident-neutron-energy-dependent, count rates and energy spectra of scattered neutrons (E sub n = 1 MeV) and secondary gamma rays (E sub gamma = 1 MeV) for incident neutron energies from 2 to 20 MeV. The measurements provide high sensitivity tests for integral and differential neutron scattering and gamma-ray production cross sections when compared with appropriate transport calculations. Differences between measurements and calculations should be interpretable in terms of specific cross-section deficiencies at well-defined incident-neutron energies from 2 to 20 MeV. The source spectrum of neutrons incident on the samples was measured by TOF using the NE-213 detector. Author (GRA)

N76-30959# Sandia Labs., Albuquerque, N.Mex.
X-RAY SIMULATION DEVELOPMENT
L. D. Posey, P. B. Tollefsrud, H. W. Woodall, D. H. McDaniel, and R. E. Allred 1975 25 p refs Presented at 5th Symp. on Nucl. Survivability of Propulsion and Ordnance Systems, Menlo Park, Calif., 7 Oct. 1975 Sponsored by ERDA
(SAND-75-5494; Conf-751094-1) Avail: NTIS HC $3.50

Design modifications are discussed for an electron beam accelerator used as a bremsstrahlung X-ray source. The primary goal of the program, to obtain a reliable 5 cal/gm exposure capability, can be accomplished with beam compression by an external magnetic guide field. Initial operating characteristics and performance improvements are presented. NSA

N76-30960# Sandia Labs., Albuquerque, N.Mex.
TECHNIQUES FOR FABRICATING AN INFRARED OPTICAL PYROMETRY SYSTEM FOR PULSED ELECTRON BEAM DIAGNOSTICS
A. L. Ouellette Jan. 1976 25 p refs
(Contract AT(29-1)-789)
(SAND-75-0464) Avail: NTIS HC $4.50

An infrared optical pyrometry system is given which was designed to make fast time resolved temperature measurements for determining the amount of energy from an electron beam or some other type of pulsed energy deposition that is absorbed in a target. The system is capable of measuring energy deposition levels up to 4,000 J/g in carbon, which corresponds to a graphite target temperature of 2,200 C. Methods of fabrication alignment, and calibration are presented. The measurement of absorbed energy in a target as a function of position and depth is discussed as a possible application, and several measurements are described which permit a comparison of results from this system with those taken by other methods. NSA

N76-30961# Los Alamos Scientific Lab., N.Mex.
NEGATIVE ION BEAM PROCESSES
T. D. Hayward, G. P. Lawrence, R. F. Bentley, J. J. Malanify, and J. A. Jackson Jun. 1975 31 p refs
(Contract W-7405-eng-36)
(LA-6019) Avail: NTIS HC $5.00

Production of intense, very bright, negative hydrogen, ion beams and conversion of a high energy negative beam into a neutral beam are described. The ion source work has used a cesium charge exchange source that has produced negative hydrogen beams greater than or equal to 10 mA with a brightness of 1.4 x 10 to the 9th power A/sq m - rad squared. The high energy neutral beam production investigations have included measurements of the 800 MeV negative hydrogen stripping cross section in hydrogen gas, the 3- to 6-MeV negative hydrogen stripping cross sections in a hydrogen plasma, and the small angle scattering that results from stripping an 800 MeV negative ion beam in hydrogen gas. Author (NSA)

N76-30962# Texas Univ., Austin. Center for Particle Theory.
DEEP INELASTIC SCATTERING IN A REGGEISED SYMMETRY MODEL
A. M. HarunarRashid Feb. 1976 40 p refs
(Contract AT(40-1)-3992)
(ORO-3992-245) Avail: NTIS HC $4.00

The phenomena of deep inelastic electroproduction and nucleon Compton scattering at high energy are systematically investigated within the framework of a Reggeised symmetry model. Using duality as the essential theoretical concept, the high omega-behavior of the structure functions is derived from the Reggeisation prescription due to Van Hove, and the low omega-behavior is obtained from the dispersion relation approach due to Schwinger. Such a unified treatment avoids many ad hoc assumptions current in the literature and results in a simple phenomenological description of the virtual photon-nucleon scattering processes. Author (NSA)

N76-30963# California Univ., Berkeley. Lawrence Berkeley Lab.
POLARIZATION PHENOMENA IN FEW-BODY SYSTEMS
H. E. Conzett Dec. 1975 12 p refs Presented at 7th Intern. Conf. on Few-body Probl. in Nuclear and Particle Phys., Delhi, India,
(Contract W-7405-eng-48)
(LBL-4351; Conf-751231-1) Avail: NTIS HC $3.50

Recent polarization studies in N-N scattering at and below 50 MeV provided specific and significant improvements in the phase-shift parameters. High energy investigations with both polarized proton beams and targets showed unexpectedly large spin effects, and this provides a challenge for theoretical effort to explain these results. Experiments and theoretical work on the three-nucleon problem continues to yield new and interesting results, with the emphasis now shifting to polarization studies in the breakup reaction. On-going work on several-nucleon systems continues to provide polarization data for general analyses, nuclear structure information, or specific resonance effects. Finally, the basic interaction symmetries continue to have unique and important consequences for polarization observables.
Author (NSA)

N76-30964# California Univ., Berkeley. Lawrence Berkeley Lab.
LECTURES ON GEOMETRICAL PROPERTIES OF NUCLEI

W. D. Myers Nov. 1975 43 p refs Presented at 8th Summer School on Nuclear Phys., Mikolajki, Poland. Sponsored by ERDA
(LBL-4342; Conf-750848-2) Avail: NTIS HC $4.00

Material concerning the geometrical properties of nuclei is drawn from a number of different sources. The leptodermous nature of nuclear density distributions and potential wells is used to draw together the various geometrical properties of these systems and to provide a unified means for their description. Extensive use is made of expansions of radial properties in terms of the surface diffuseness. A strong case is made for the use of convolution as a geometrical ansatz for generating diffuse surface distributions because of the number of simplifications that arise which are of practical importance. Author (NSA)

N76-30965# California Univ., Berkeley. Lawrence Berkeley Lab.
APPLICATION OF GENERALIZED CLASSICAL TRAJECTORIES IN NUCLEAR PHYSICS Ph.D. Thesis
H. M. Leser Sep. 1975 194 p refs
(Contract W-7405-eng-48)
(LBL-4316) Avail: NTIS HC $7.50

A new semi-classical method, the so-called uniform semiclassical approximation, is described briefly and then applied to two nuclear physics problems. The first problem considered is the backscattering from a deformed nucleus and the excitation of rotational states in the target at energies up to the Coulomb barrier. The multiple Coulomb excitation calculations are in quantitative agreement with a very different method (the de Boer-Winther code). A nuclear optical potential is also considered and the nuclear-Coulomb interference for heavy ions is studied. The second problem considered is the tunneling through a two-dimensional barrier. This problem (which is supposed to simulate the penetration through a two-dimensional fission barrier) is investigated by a fully quantum-mechanical coupled channel calculation and by the uniform semiclassical approximation. A quantitative agreement is found. Author (NSA)

N76-30966# Brookhaven National Lab., Upton, N.Y. National Neutron Cross Section Center.
ROLE AND USE OF NUCLEAR THEORIES AND MODELS IN PRACTICAL EVALUATION OF NEUTRON NUCLEAR DATA NEEDED FOR FISSION AND FUSION REACTOR DESIGN AND OTHER NUCLEAR APPLICATIONS
A. Prince 1975 132 p refs Presented at the Meeting on the Use of Nuclear Theory in Neutron Nuclear Data Evaluation, Trieste, Italy, 8-12 Dec. 1975 Sponsored by ERDA
(BNL-20700; Conf-751220-1) Avail: NTIS HC $6.00

Computer codes embodying the principles of the relevant nuclear models are compared with each other and with experimental data. The regions of validity and limitations of the conceptual formalisms are also included, along with the effects of the numerical procedures used in the codes themselves. Conclusions and recommendations for future demands are outlined. Author (NSA)

N76-30967# Los Alamos Scientific Lab., N.Mex.
CROSS SECTIONS FOR CREATION OF DAMAGE
M. Lott, J. P. Genthon, F. Gervaise, P. Mas, J. C. Mougniot, and N. Vandoan 1976 43 p refs Transl. into ENGLISH from French Symp. Presented at the Symp. on Appl. of Nuclear Data in Sci. and Technol., Paris, France, 12-16 Mar. 1973 p 89-126
(LA-tr-76-5) Avail: NTIS HC $4.00

Differential cross sections representing the rate of creation of damage are established; with these it is possible to calculate the simplest quantities associated with irradiation-i.e., the energy imparted to the material in the form of elastic collisions and the number of displacements per atom. The data necessary for calculating these damage functions are: (a) the neutron cross sections (elastic and inelastic) with their angular distributions; with these it is possible to calculate the spectrum of the (primary) recoil atoms associated with a neutron collision; (b) the energy given up and the number of atoms displaced by the primary atom, which are calculated by means of Lindhardt's universal curve. The ARTUS and SOURCE codes are used in calculating with these data the energy imparted to the lattice and the number of displacements per atom. ARTUS X is linked with the UKNDF file. Results are given for all usual cases of common metals and steel. Author (NSA)

N76-30968# Institutul de Fizica Atomica, Bucharest (Romania).
THREE NUMERICAL METHODS FOR THE COMPUTATION OF THE ELECTROSTATIC ENERGY
D. N. Poenaru and D. Galeriu 1975 20 p refs
(IFA-CRD-60-1975) Avail: ERDA Depository Libraries HC $3.50

The FORTRAN programs for computation of the electrostatic energy of a body with axial symmetry by Lawrence, Hill-Wheeler and Beringer methods are presented in detail. The accuracy, time of computation and the required memory of these methods are tested at various deformations for two simple parametrizations: two overlapping identical spheres and a spheroid. On this basis the field of application of each method is recommended. Author (NSA)

N76-30969# Bureau of Radiological Health, Rockville, Md.
ANNUAL NATIONAL CONFERENCE ON RADIATION CONTROL (7TH): ASSURING RADIATION PROTECTION, HELD AT HYANNIS, MASS. ON APR. 27 - MAY 2, 1975
Feb. 1976 318 p refs Sponsored in part by EPA, Washington, D.C., and Nuclear Regulatory Commission, Washington, D. C.
(PB-251344/8; DHEW(FDA)-76-8026) Avail: NTIS HC $9.75 CSCL 18H

The publication contains the proceedings of the 7th Annual National Conference held April 27-May 2, 1975. Sponsors were the Conference of Radiation Control Program Directors, the Bureau of Radiological Health, the Environmental Protection Agency, and the U.S. Nuclear Regulatory Commission. Participants representing State and major local radiation control programs, as well as Federal agencies, discussed mutual radiation control programs. The formal presentations and the reports of the various task forces and workshops are included. GRA

N76-30970# California Univ., Berkeley. Dept. of Nuclear Engineering.
HEAT TRANSFER DURING THE REFLOODING PHASE OF THE LOCA-STATE OF THE ART
G. Yadigaroglu, K. P. Yu, L. A. Arrieta, and R. Grief Sep. 1975 160 p refs Sponsored by Electric Power Res. Inst.
(PB-246270/3; EPRI-248-1) Avail: NTIS HC $6.75 CSCL 18I

A general description of the loss-of-coolant accident in light water reactors and of the emergency core cooling systems and a detailed description of the reflooding phase of this accident are given. Analytical models are codes for calculating the reflooding transients used in the U.S. for licensing purposes, as well as developmental computer programs aboard are reviewed. A detailed examination of all the experimental evidence available from reflooding experiments is made. Both single-channel and rod-bundle experiments conducted in the U.S. and abroad are comprehensively and critically reviewed. GRA

74 OPTICS

Includes light phenomena.

N76-30971 Washington Univ., Seattle.
OPTICAL PROPERTIES OF SOME RARE EARTH METALS Ph.D. Thesis
Graeme Arden Blake 1975 324 p
Avail: Univ. Microfilms Order No. 76-17406

Optical constants in the spectral range 0.55-5.50eV are presented for the heavy rare earth metals Gd, Tb, and Dy. The samples are thin films evaporated in UHV and studied in situ temperatures both above and below their respective Curie temperatures. The optical spectra are broadly similar for the three. Gd and Tb display small absorptions below Tc at 1.1 and 0.8 eV respectively; believed to be of ferromagnetic origin. Both critical point analysis and a new combination of atomic ideas with joint density of states calculations are applied to explain the broad structure. AJDSA results making use of the s,p, and d density of states for Gd as calculated by Harmon, atomic wavefunction calculations of Hermann and Skillman and the Stoner model

successfully predict the presence and magnitude of a ferromagnetic absorption, but the energy agreement is only fair. Dissert. Abstr.

N76-30972 Arizona Univ., Phoenix.
A COMPARISON OF CODED APERTURE IMAGING SYSTEMS CONTAINING ZONE PLATE AND RANDOM-PHASE CODE FUNCTIONS Ph.D. Thesis
Frank Roger Whitehead 1976 112 p
Avail: Univ. Microfilms Order No. 76-18249

Coded aperture imaging systems provide an alternative to the conventional pinhole camera imaging system normally used for producing images of gamma-ray and X-ray emitting objects from astronomical observations. A detailed analysis of coded aperture systems is given using on-axis and off-axis zone plate apertures, and a random-phase coded aperture made by holographically recording the image of a ground glass diffusing screen. A comparison of the off-axis zone plate- and random-phase code for three-dimensional objects was made by determining the out-of-focus spread functions for each system. The off-axis zone plate coded aperture is shown to produce an out-of-focus spread function which contains high frequency object information, and therefore such a system becomes susceptible to generation of object dependent artifacts in the images from three-dimensional objects. The random-phase coded aperture is shown to produce an out-of-focus spread function which does not contain high frequency object information, and this code function there fore provides better images of three-dimensional object distributions. Dissert. Abstr.

N76-30973 Washington Univ., Seattle.
SPATIAL BANDLIMITING EFFECTS IN OPTICAL DATA PROCESSORS Ph.D. Thesis
Monte Richard Mueller 1975 154 p
Avail: Univ. Microfilms Order No. 76-17569

An optical Laplace transform computer was developed for which experimental data demonstrated a need for a convergence or noise filter on the input data. The necessity for this filter is found to arise from a finite input pupil function. With the additional filter, the ideal response can be approximated although a product of the input signal and the input filter is considerably modified from the original input signal. It is concluded that due to spatial bandlimiting, the Laplace transform is not practically suited for optical computation. It is important, however, to have identified the physical parameters of the optical system that limit its usefulness. Also examined are system limitations in the much used optical Fourier transform computer. The Fourier transform relationship is also found to be inexact due to spatial bandlimiting. A theoretical model is derived that identifies possible sources of bandlimiting and also investigates several filtering techniques for compensation. Dissert. Abstr.

N76-30974 Arizona Univ., Tucson.
THE TECHNIQUES AND TOLERANCING REQUIRED FOR PHASING HEXAGONALLY-CONFIGURED SYNTHETIC APERTURE IMAGING SYSTEMS Ph.D. Thesis
Gregory Marshall Sanger 1976 293 p
Avail: Univ. Microfilms Order No. 76-18252

A practical technique is developed for the phased operation of a hexagonally-configured synthetic-aperture imaging system. This system consists of six identical circular sub-apertures, centered on the apexes of a regular hexagon, and is capable of achieving a spatial resolution nearly equal to that of an equivalent single-aperture system. Phased and nonphased images are compared with each other and with images produced by the equivalent single-aperture system. Independent afocal telescopes show the most promise for phased operation in the visible and near infrared regions of the spectrum. Basic geometry requirements are examined, and tolerance limits are obtained for piston error, tilt, decenter, atmospheric turbulence, and such support-system errors as gravity-induced sag and warping. The tolerance limit for any single error, or combination of errors, is established when the cross-correlation of the diffraction-limited impulse response and the aberrated impulse response falls to a specific value. Dissert. Abstr.

N76-30975 Washington Univ., Seattle.
ESTIMATION OF THE MACROSCOPIC OPTICAL SCATTERING PARAMETERS OF TENUOUS SOLUTIONS Ph.D. Thesis
Jonathan Molcho 1975 176 p
Avail: Univ. Microfilms Order No. 76-17570

The estimation of the macroscopic optical light scattering parameters of tenuous solutions is investigated with a view toward the development of a rapid technique for bacteria count in urine. Some of the species of the particulate content of urine may be eliminated by simple procedures. The concentration of the remaining species is determined by decomposition of the macroscopic parameters into its contributions from each species. The macroscopic parameters are estimated from measurements of light scattered from the solution at discrete angles of observation. The scattered intensity is given by the solution of the radiative transport equation under the first order multiple scattering approximation. Computer simulation of various nonlinear estimation schemes show strong dependence of the estimation accuracy on the noise content of the measured data, hence a strong low-pass filtration of the signal is required. The main source of noise is traced to fluctuations in particle concentration due to their Brownian motion. Dissert. Abstr.

N76-30976 Michigan State Univ., East Lansing.
MODIFIED KUBELKA-MUNK ANALYSIS FOR THE APPROXIMATE THEORY OF MULTIPLE SCATTERING Ph.D. Thesis
Kaeo Songkhao 1976 204 p
Avail: Univ. Microfilms Order No. 76-18679

The transmission and reflection of light in light-scattering layers is discussed on the basis of a set of simultaneous differential equations. Formulas previously developed by Kubelka and Munk are briefly recapitulated and then extended to describe the exponential solutions, the semi-hyperbolic solutions, and hyperbolic solutions. The shortcomings of these formulas for practical applications is well known. To overcome these shortcomings, appropriate formulas were developed. To test their validity, experiments were performed with pigmented lacquer films as specimens. Experimental and calculated results for lacquers containing individual pigments, and for lacquer containing much of the pigment were compared in terms of infinite reflectance and CIE chromaticity coordinates. Comparison of experimental and calculated results shows that the method developed gives reliable estimates of reflectance and color both in the individual pigment and mixed-pigment lacquer films. Dissert. Abstr.

N76-30977*# Lockheed Missiles and Space Co., Palo Alto, Calif.
THE LOCKHEED ALTERNATE PARTIAL POLARIZER UNIVERSAL FILTER Final Report, 8 Oct. 1974 - 7 Oct. 1975
Alan M. Title Mar. 1976 72 p refs
(Contract NAS5-20783)
(NASA-CR-144789; LMSC-D501627) Avail: NTIS HC $4.50 CSCL 20F

A tunable birefringent filter using an alternate partial polarizer design has been built. The filter has a transmission of 38% in polarized light. Its full width at half maximum is .09A at 5500A. It is tunable from 4500 to 8500A by means of stepping motor actuated rotating half wave plates and polarizers. Wave length commands and thermal compensation commands are generated by a PPD 11/10 minicomputer. The alternate partial polarizer universal filter is compared with the universal birefringent filter and the design techniques, construction methods, and filter performance are discussed in some detail. Based on the experience of this filter some conclusions regarding the future of birefringent filters are elaborated. Author

N76-30978# Massachusetts Inst. of Tech., Cambridge. Center for Policy Alternatives.
SOME CONSIDERATIONS IN CHOOSING AN OCCUPATIONAL NOISE EXPOSURE REGULATION
Nicholas A. Ashford, Dale Hattis, and George Heaton Feb. 1976 95 p refs
(PB-251408/1; CPA-75-11; EPA-550/9-76-007) Avail: NTIS HC $5.00 CSCL 06H

Some issues in conflict regarding the proposed OSHA standard for occupational exposure to noise are examined. These include material impairment, the extent of possible hearing loss, nonauditory effects, and the nature of social and economic costs

benefits of regulation at 85 dBA and 90 dBA exposure limits. A preliminary analysis of the methodology and difficulties in arriving at cost benefit estimates is included. Regulatory alternatives such as new plant standards, industry specific standards, variances and abatement agreements, administrative controls, and personal protective equipment are explored. GRA

N76-30979# Texas Instruments, Inc., Dallas. Central Research Labs.
GaAs OPTICAL STRIPLINE Annual Report, 3 Feb. 1975 - 3 Feb. 1976
J. C. Campbell and K. L. Lawley 26 Feb. 1976 43 p refs
(Contract N00014-75-C-0501; NR Proj. 009-015)
(AD-A022393; TI-08-76-12) Avail: NTIS CSCL 20/6

This report describes work on optical stripline waveguide modulators and switches. Seventy percent amplitude modulation was achieved with two types of single-stripline modulators. Several sets of optical stripline directional couplers having different waveguide widths and separations were fabricated; passive 3 dB coupling lengths as short as 2.0 mm with 97% power transfer were observed. Stripline directional coupler switches were fabricated in which switching as high as 90% was observed. Materials growth and fabrication techniques required in this program are described in Section II of this report. A discussion of the work on the waveguide modulator and the directional coupler switch is contained in Sections III and IV. GRA

N76-30980# Stanford Univ., Calif. Microwave Lab.
ACOUSTICALLY SCANNED OPTICAL IMAGING DEVICES Semiannual Report, 1 Jul. - 31 Dec. 1975
Gordon S. Kino Feb. 1976 57 p refs
(Contract N00014-76-C-0129; ARPA Order 2778)
(AD-A022123; SU-ML-2525; SAR-1) Avail: NTIS CSCL 20/6

The aim of the work on this contract during the last six months has been to improve the technology of the optical imaging devices so that we can carry out more sophisticated studies of optical transform methods; and can make reproducible devices with reasonably uniform characteristics, so we need not spend a large amount of time with difficult problems of mechanical alignment. In addition, we have been concerned to eliminate the trapping problem in zinc oxide, to eliminate sideways diffusion of carriers generated by light, so as to keep a constant modulation transfer factor, and to eliminate problems with surface states in both airgap and ZnO devices. GRA

N76-30981# Massachusetts Inst. of Tech., Cambridge. Center for Materials Science and Engineering.
RESEARCH IN MATERIALS SCIENCE. 1: OPTOELECTRONIC MATERIALS AND COMPONENTS MINIATURIZED THIN FILM LASER SOURCES AND MODULATORS. 2: SUPERCONDUCTING TRANSITION METAL ALLOYS. 3: CHEMICAL SYNTHESIS USING HIGH TEMPERATURE LITHIUM VAPOR SPECIES Semiannual Technical Report, 1 Jul. - 31 Dec. 1975
D. J. Epstein, R. M. Rose, M. Macvicar, and R. Lagow 31 Dec. 1975 96 p refs
(Contract N00014-75-C-1084; ARPA Order 2994)
(AD-A022096; STR-1) Avail: NTIS CSCL 20/6

Routes for the synthesis of polylithiocarbons, perlithiocarbons, and inorganic polylithium species were discovered. The new synthetic methods are all in the early stages of development and involve the reaction of high temperature lithium vapor in the range of 800-1,000 C with various organic, inorganic and polymeric species. The synthesis of the first perlithioalkanes, tetralithiomethane, C(Li), and hexalithioethane, C2Li6 was accomplished as well as that of hexalithiobenzene, C6Li6, and over thirty such polylithium compounds. It appears that polylithiocarbons will be very useful reagents in organic synthesis as well as important monomers and crosslinking agents in polymer synthesis. The synthesis of several types of three dimensional polymers and high temperature materials based on routes involving these new polylithium species is discussed. Author

N76-30982# National Bureau of Standards, Washington, D.C. Optical Physics Div.
SELF STUDY MANUAL ON OPTICAL RADIATION MEASUREMENTS: PART 1. CONCEPTS, CHAPTERS 1 TO 3. CHAPTER 1 - INTRODUCTION. CHAPTER 2 - DISTRIBUTION OF OPTICAL RADIATION WITH RESPECT TO POSITION AND DIRECTION (RADIANCE). CHAPTER 3 - SPECTRAL DISTRIBUTION OF OPTICAL RADIATION
Fred E. Nicodemus, Henry J. Kostkowski, and Albert T. Hattenburg Mar. 1976 95 p refs
(PB-251331/5; NBS-TN-910-1) Avail: NTIS HC $5.00 CSCL 20F

This is the initial publication of a new series of Technical Notes (910) entitled 'A Self-Study Manual on Optical Radiation Measurements.' It contains the first three chapters of this Manual. The first chapter is an introduction that includes a description of optical radiation and the ray approach to its treatment in this Manual (based on geometrical optics), a discussion of relevant parameters and their use in a measurement equation as a systematic technique for analyzing measurement problems, and a presentation of the system of units and nomenclature used. The second chapter, on the distribution of optical radiation with respect to position and direction, introduces the basic radiometric quantity, radiance, and its important invariance properties. It is shown how to determine the total power in a beam from the radiance distribution and to determine the distribution of radiance at any surface, through which the beam passes, in terms of the distribution at any other surface that also intersects the entire beam. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N76-30983 North Carolina State Univ., Raleigh.
PLANE WAVE PROPAGATION IN PLASMA SLABS Ph.D. Thesis
Macmillan Morgan Wisler 1975 75 p
Avail: Univ. Microfilms Order No. 76-17263

Electromagnetic plane wave propagation is studied in an isotropic one dimensionally varying plasma slab. Riccati-type differential equations are derived in terms of reflection and transmission coefficients which are a function of distance into the plasma. A flow diagram method is used to derive the differential equations. The transmission coefficient for a plasma slab with an arbitrary but known profile is derived as the sum of two terms, the classical WKB approximate solution and a WKB error term the error term being the difference between the exact transmission coefficient and the WKB approximate coefficient. The error term is expressed as the integral over distance through the plasma of the incremental error incurred by using the WKB approximation. Dissert. Abstr.

N76-30984 Wisconsin Univ., Madison.
FEEDBACK STABILIZATION OF ELECTROSTATIC REACTIVE INSTABILITIES Ph.D. Thesis
Roger Keith Richards 1976 147 p
Avail: Univ. Microfilms Order No. 76-16013

A general theory for the feedback stabilization of electrostatic reactive instabilities was developed which includes the effects of dissipation in the plasma and frequency dependence in the sensor-suppressor elements and in the external feedback circuit. This theory was compared to experiments involving a particular reactive instability, an interchange mode, found in a magnetic mirror device. The results are found to be in good agreement with theory. One noteworthy result is that a frequency dependence in the overall gain and phase shift of the feedback loop can cause destabilization at large gain. Multimode feedback stabilization was studied using the spatial variation of two interchange modes to separate them such that each could be acted upon individually by the feedback system. The transfer function of the plasma was also examined. This analysis was used for mode identification and location of the pole positions. Feedback was also used as a diagnostic tool for studying instability induced transport. Dissert. Abstr.

N76-30985 Washington Univ., Seattle.
EXPERIMENTAL STUDY OF A LASER-HEATED SOLENOID

Ph.D. Thesis
Henry Leo Rutkowski 1975 137 p
Avail: Univ. Microfilms Order No. 76-17607

The results are presented of an experimental investigation of the interaction of an intense CO2 laser beam with a column of initially UV-ionized hydrogen immersed in a steady magnetic field of up to 100 kG. Time and space resolved measurements of the plasma electron density were made using holographic interferometry along the axis and Mach-Zehnder interferometry across the column. The temperature was determined by measuring the decay rate of a line from CV in the quartz UV. These measurements were supplemented by streak photography to provide data on the development of the luminosity of the plasma column, radially and axially, as a function of time. From these various diagnostic techniques, it was possible to determine that a density minimum is formed on-axis within a few tens of nanoseconds after initiation of the laser pulse. This effectively produces a light pipe which traps the beam, and suggests that long columns can be formed by laser irradiation. Dissert. Abstr.

N76-30986 Princeton Univ., N.J.
THE BEHAVIOR AND STRUCTURE OF SHOCK WAVES IN NONEQUILIBRIUM PLASMAS Ph.D. Thesis
Marc Harrison Williams 1975 289 p
Avail: Univ. Microfilms Order No. 76-17698

The effects of electron thermal nonequilibrium and ion neutral mass discrepancy on the dynamics and structure of shocks in nonreactive partially ionized gases is investigated. The development of an initial planar discontinuity on the electron thermal equilibrium time scale is discussed from the point of view of the Boltzmann equation, in order to clarify the effect of thermal relaxation on the propagating shock wave. The structure of the shock is then analyzed for various mixtures to show the possible interactions between particle inertia and the induced electric field. The dominant parameters effecting the component behaviors are the ion to neutral mass ratio and the electron to neutral temperature ratio. Dissert. Abstr.

N76-30987 Maryland Univ., College Park.
THEORETICAL STUDIES OF SELECTED PHENOMENA IN SPACE AND LABORATORY PLASMAS Ph.D. Thesis
Joseph Donald Huba 1975 162 p
Avail: Univ. Microfilms Order No. 76-17806

Several relationships between the power spectra of density and velocity fluctuations and the power spectrum of magnetic field fluctuations are derived for the solar wind within the context of plasma kinetic theory. A local, turbulent diffusion process which may rapidly refill the partial cavity of energetic particles created by Io's passage through a flux tube is discussed. A model is developed of Io's sweeping action on energetic particles in which a wake is formed behind the flux tube threading Io. A linear and quasi-linear analysis of the lower hybrid drift instability is performed for finite beta sub e in the low drift velocity regime, including the effects of a magnetic gradient drift resonance. Dissert. Abstr.

N76-30988 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
A KINETIC EQUATION FOR HIGH DENSITY, HIGH TEMPERATURE PLASMAS Ph.D. Thesis
John Alvern Decaire 1975 98 p
Avail: Univ. Microfilms Order No. 76-17303

An analytical procedure to describe plasma kinetic theory was developed. The analysis is based on the Wigner phase space formulation of quantum statistical mechanics and its associated Bogoliubov-Born-Green-Kirkwood-Yvon (BBGKY) hierarchy of equations for q-body (q = 1,2, ..) correlation clusters. Extensive use is made of diagrammatic perturbation analysis, operator-state space methods, and the convenient bra-ket notation. Parameters that are physically descriptive of interaction strength, many-body nature, and quantum statistical effects are introduced for ordering analysis of relevant kinetic contributions. Derivations of kinetic equations are based on binary correlation approximations associated with selection of consistently ordered terms. Utility of the analysis is demonstrated by deriving the well-known Vlasov, Landau, Balescu-Guernsey-Lenard and Uehling-Uhlenbeck equations. Using the technique, a new plasma kinetic equation which describes strong many-body interactions is derived. Dissert. Abstr.

N76-30989 Washington Univ., Seattle.
APPLICATION OF OPTIMAL CONTROL THEORY TO LASER HEATING OF A PLASMA IN A SOLENOIDAL MAGNETIC FIELD Ph.D. Thesis
Robert Dale Neal 1975 189 p
Avail: Univ. Microfilms Order No. 76-17576

Laser heating of a plasma column confined by a solenoidal magnetic field is studied via modern optimal control techniques. A two temperature, constant pressure model is used for the plasma so that the temperature and density are functions of time and location along the plasma column. The localized behavior of the plasma heating dynamics is first studied and conventional optimal control theory applied. On a localized basis, the temperature and density are functions of time only so the heating dynamics model reduces to a set of ordinary but non-linear differential equations. Typical numerical cases are presented and some plasma parameters are varied in order to study the design tradeoffs. The distributed parameter optimal control problem is next considered with minimum time to reach a specified final ion temperature criterion as the objective. Dissert. Abstr.

N76-30990*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ION TEMPERATURES IN HIP-1 AND SUMMA FROM CHARGE-EXCHANGE NEUTRAL OPTICAL EMISSION SPECTRA
R. W. Patch and M. R. Lauver 1976 41 p refs Presented at Conf. on Diagnostics of High Temperature Plasmas, Knoxville, Tenn., 7-9 Jan. 1976; sponsored by the Div. of Plasma Physics of the Am. Physical Soc.
(NASA-TM-X-73471; E-8604) Avail: NTIS HC $4.00 CSCL 20I

Ion temperatures were obtained from observations of the H sub alpha, D sub alpha, and He 587.6 nm lines emitted from hydrogen, deuterium, and helium plasmas in the SUMMA and HIP-1 mirror devices at Lewis Research Center. Steady state discharges were formed by applying a radially inward dc electric field between cylindrical or annular anodes and hollow cathodes located at the peaks of the mirrors. The ion temperatures were found from the Doppler broadening of the charge-exchange components of spectral lines. A statistical method was developed for obtaining scaling relations of ion temperature as a function of current, voltage, and magnetic flux density. Derivations are given that take into account triangular monochromator slit functions, loss cones, and superimposed charge-exchange processes. In addition, the Doppler broadening was found to be sensitive to the influence of drift on charge-exchange cross section. The effects of finite ion-cyclotron radius, cascading, and delayed emission are reviewed. Author

N76-30991# Princeton Univ., N.J. Plasma Physics Lab.
HIGH FREQUENCY PARAMETRIC WAVE PHENOMENA AND PLASMA HEATING: A REVIEW
M. Porkolab Nov. 1975 70 p refs Presented at the 12th Intern. Conf. on Phenomena in Ionized Gases, Eindhoven, the Netherlands, 18-22 Aug. 1975
(Contract E(11-1)-3073)
(MATT-1172; Conf-750877-2) Avail: NTIS HC $4.50

A survey of parametric instabilities in plasma, and associated particle heating, is presented. A brief summary of linear theory is given. The physical mechanism of decay instability, the purely growing mode (oscillating two-stream instability) and soliton and density cavity formation is presented. Effects of density gradients are discussed. Possible nonlinear saturation mechanisms are pointed out. Experimental evidence for the existence of parametric instabilities in both unmagnetized and magnetized plasmas is reviewed in some detail. Experimental observation of plasma heating associated with the presence of parametric instabilities is demonstrated by a number of examples. Possible application of these phenomena to heating of pellets by lasers and heating of magnetically confined fusion plasmas by high power microwave sources is discussed. Author (NSA)

N76-30992# Oak Ridge National Lab., Tenn.
PLASMA HEATING IN THE TM-3 TOKAMAK AT ELECTRON-

CYCLOTRON RESONANCE WITH MAGNETIC FIELDS UP TO 25 ke

V. V. Alikaev, G. A. Bobrovskii, V. I. Poznyak, K. A. Razumova, V. V. Sannikov, Yu. A. Sokolov, and A. A. Shmarin 1975 8 p refs Transl. into ENGLISH from report no. IAE-2564 (Moscow), 1975 Sponsored by ERDA

(ORNL-TR-4080) Avail: NTIS HC $3.50

Experiments were conducted in heating plasma at electron-cyclotron resonance (ECR) with longitudinal magnetic fields up to 25 ke. It was shown by the aid of laser diagnosis that the temperature of the basic component of the electrons increases in accordance with the classical mechanism of heating at ECR in the process of electron-cyclotron heating (ECH). The distribution of the temperature of electrons with respect to radius was measured. The relationship of energetic lifetime in the Tokamak and electron temperature was obtained and the magnitude of energetic lifetime of accelerated electrons in the function of their energy was estimated. The value beta/sub tau/ approximately equal to 2.2 was obtained by the aid of ECH in a regime with small discharge currents. NSA

N76-30993# University of South Florida, Tampa. Dept. of Physics.

CONTINUATION OF INVESTIGATION OF TURBULENT HEATING SCHEMES Annual Progress Report

W. D. Jones and N. L. Oleson 24 Feb. 1976 36 p refs

(Contract AT(40-1)-4338)

(ORO-4338-8) Avail: NTIS HC $4.00

The linear turbulent heating device was modified and improved, three new major diagnostic systems were put into operation, and most important of all, the catalytic turbulent heating by spatial magnetic field variations was successfully demonstrated. One basic goal is to increase the efficiency of coupling energy into low frequency modes which in turn heat the ions selectively. The experimental resuls strongly indicate this is the case. It is conceivable that ion heating can be improved by the presence of either intentional or unavoidable magnetic field variations. NSA

N76-30994# Massachusetts Inst. of Tech., Cambridge.

NUMERICAL INVESTIGATION OF TOROIDAL AXISYMMETRIC FREE BOUNDARY EQUILIBRIA WITH EXTERNAL CONDUCTORS

G. Cenacchi, R. Galvao, and A. Taroni Aug. 1975 55 p refs Prepared in cooperation with the Comitato Nazionale per L'Energia Nucleare, Rome

(Contract EA(11-1)-3070)

(RT/FIMA-(75)4) Avail: NTIS HC $4.50

An extensive numerical study of magnetic confinement configurations with noncircular cross sections is described. The plasma column is kept in equilibrium by a conducting shell or by currents flowing in external conductors, without the shell. The stability of the equilibrium configurations against localized flute modes is tested by using the Mercier criterion. The possibility of obtaining stable equilibria at low aspect ratios (R/a difference 2) is demonstrated. It is also shown that non-circular cross section devices with fairly large plasma currents (Ip difference 2MA) can be constructed without a shell to keep the plasma in equilibrium. NSA

N76-30995# Johns Hopkins Univ., Baltimore, Md.

EXTREME ULTRAVIOLET AND SOFT X-RAY DIAGNOSTICS OF HIGH TEMPERATURE PLASMAS Annual Progress Report, 1 Jun. 1975 - 31 May 1976

H. W. Moos, L. Armstrong, Jr., and W. G. Fastie 1976 20 p refs

(Contract E(11-1)-2711)

(COO-2711-1) Avail: NTIS HC $3.50

The report discusses the four major research areas of this program: diagnostic studies of CTR plasmas, laboratory spectroscopy and calibration at short wavelengths, theoretical computation of transition probabilities for highly ionized atoms, and instrument development for short wavelength studies of CTR devices. Using existing instruments, diagnostic studies are under way at Versator and Elmo Bumpy Torus. A facility was completed for the sensitivity calibration of spectrometers down to 300 A as complete units. The development of computer programs necessary for transition probability calculations is ninety percent complete. An f/20 forty cm focal length concave grating spectrometer has been constructed utilizing very high vacuum techniques to reduce contamination of plasma devices and calibration sources such as SURF II at NBS. New designs for grazing incidence monochromators have been developed. NSA

N76-30996# Sydney Univ. (Australia). School of Physics.

HEATING AND IONIZATION IN MHD SHOCK WAVES PROPAGATING INTO PARTIALLY IONIZED PLASMA

L. Bighel, A. R. Collins, N. F. Cramer, and C. N. Watson-Munro Sep. 1975 7 p refs Presented at the 7th European Conf. on Controlled Fusion and Plasma Physics, Lausanne, Switzerland, 1-5 Sep. 1975 Sponsored in part by the Australian Research Grants Committee and the Australian Inst. of Nuclear Science and Engineering

(CONF-750905-24) Avail: ERDA Depository Libraries HC $3.50

A model of the structure of MHD switch-on shocks propagating in a partially ionized plasma, in which the primary dissipation mechanism is friction between ions and neutrals, is here compared favorably with experimental results. Four degrees of upstream ionization were studied, ranging from almost complete to very small ionization. NSA

N76-30997# Florida Univ., Gainesville. Dept. of Physics.

STARK BROADENENING IN HOT, DENSE LASER-PRODUCED PLASMAS

R. J. Tighe and C. F. Hooper, Jr. 1976 36 p refs Sponsored in part by Calif. Univ., Livermore. Lawrence Livermore Lab. and ERDA

(UCRL-13669) Avail: NTIS HC $4.00

Broadened Lyman-alpha X-ray lines from neon 10 and argon 18 radiators, which are immersed in a hot, dense deuterium or deuterium-tritium plasma, are discussed. In particular, these lines are analyzed for several temperature-density cases, characteristic of laser-produced plasmas; special attention paid to the relative importance of ion, electron, and Doppler effects. Static ion microfield distribution functions are tabulated. NSA

N76-30998# Los Alamos Scientific Lab., N.Mex.

OHMICALLY HEATED HIGH-DENSITY Z PINCH

J. E. Hammel Jan. 1976 5 p refs

(Contract W-7405-eng-36)

(LA-6023-MS) Avail: NTIS HC $4.50

The gross properties of a high-density, small-radius, gas-imbedded Z pinch have been examined considering only classical processes. The rate equation using only ohmic heating along with bremsstrahlung and radial heat transport shows that ohmic heating will rapidly take the pinch to thermonuclear temperatures for currents, I, greater than 1 MA. The radial heat loss for the pinch is very small for I greater than 1.5 MA. This suggests that the pinch could tolerate being driven to a nearby wall by an m equals 1 kink. The laser technology for initiation of the small-diameter filament and the high-voltage technology for giving a 30-ns rise to a MA or more are available now. Some reactor considerations are included. Author (NSA)

N76-30999# Princeton Univ., N.J. Plasma Physics Lab.

PLASMA-WALL INTERACTION IN ATC DURING HIGH POWER NEUTRAL BEAM INJECTION

S. A. Cohen 1976 21 p refs Presented at 2d Intern. Conf. on Surface Effects in Controlled Fusion Devices, San Francisco, Calif., 16 Feb. 1976 Sponsored by ERDA

(CONF-760209-4) Avail: NTIS HC $3.50

Measurements of the elemental composition of the vacuum vessel wall surface and impurity influx into ATC during high power beam-heated discharges are combined with previous measurements of power balance and scaling laws to give a self consistent model of plasma-wall interaction in ATC. It is shown that plasma charge exchange induced desorption is the main cause of impurity influx during neutral beam injection. Impurities change the net power balance in these beam-heated discharges by approximately 15 percent. Author (NSA)

N76-31000# Illinois Univ., Urbana.

PELLETS FOR FUSION REACTOR REFUELING Annual Progress Report, 1 Jan. 1975 - 31 Dec. 1975

R. J. Turnbull Jan. 1976 91 p refs

(Contract E(11-1)-2234)
(COO-2234-9) Avail: NTIS HC $5.00

The feasibility of refueling fusion reactors using pellets of deuterium-tritium is discussed. A pellet injector has been constructed and experiments have been done injecting solid pellets into the ORMAK machine. Theoretical explanations of the results from these experiments have been successful. Other experiments underway include techniques for charging the pellets in order to accelerate and control them. NSA

N76-31001# Energy Research and Development Administration, Washington, D.C. Div. of Controlled Thermonuclear Research.
FUSION POWER RESEARCH AND DEVELOPMENT: MAGNETIC CONFINEMENT EXPERIMENTS Summary Report
Jan. 1976 78 p refs
(ERDA-76-34) Avail: NTIS HC $5.00

The report is divided into five sections which discuss, respectively, Tokamaks, Theta Pinches, Mirrors, Z Pinches, and Elmo Bumpy Torus. Each section contains a brief introduction to the general principles of the confinement concept together with a discussion of the relevant machine and plasma parameters. The overview is followed by a description of each device including the name of the device, the laboratory, the principal investigator, the DCTR contact, a brief discussion of the nature and purpose of the device, the machine and plasma parameters, and the major results of the device. Finally, a summary table of parameters is provided. NSA

N76-31002# California Univ., Irvine. Dept. of Physics.
SURFACE FILAMENT OF A RELATIVISTIC ELECTRON BEAM IN A PLASMA
K. Molvig and C. W. Roberson 1975 21 p refs
(Contract AT(04-3)-34)
(UCI-75-41) Avail: NTIS HC $3.50

The electromagnetic instability of a relativistic electron beam in a plasma that is current and charge neutralized in the beam channel. In addition to the usual filamentary instability one finds an instability that is localized to the surface of the beam. The large azimuthal mode number growth rate in cylindrical geometry is omega/sub i/equals omega/sub b//radical 2 gamma. The effects of collisions, a conducting wall, magnetic field, hollow beam geometry and different plasma densities, inside and outside the beam, are calculated. NSA

N76-31003# California Univ., Irvine. Dept. of Physics.
FILAMENTARY INSTABILITIES OF ROTATING ELECTRON BEAMS
K. Molvig, G. Benford (Lawrence Livermore Lab., Livermore, Calif.), and W. C. Condit, Jr. 1975 46 p refs
(Contract AT(04-3)-34)
(UCI-75-14) Avail: NTIS HC $4.00

A rotating, relativistic electron beam is highly unstable if its net current is neutralized by a background plasma, which causes the beam to break up into a series of concentric doughnuts (ring tearing). An external magnetic field cannot inhibit this perturbation. Growth rates were calculated in the thin beam approximation, and numerical simulations indicate linear growth times. Growth saturates when the relativistic electrons are sufficiently thermalized to satisfy a pinch equilibrium condition and they oscillate in the magnetic wells formed by the field perturbations. An additional feature of the mode in this geometry is a radial electrostatic field which is necessary to drive the crossfield current. NSA

N76-31004# Los Alamos Scientific Lab., N.Mex.
TWO-STEP MODEL OF SCYLLAC EQUILIBRIUM
G. Miller Jan. 1976 8 p refs
(Contract W-7405-eng-36)
(LA-6204-MS) Avail: NTIS HC $4.50

The simplest sharp boundary MHD equilibrium theory of Scyllac, assuming nearly cylindrical geometry, is extended to a two-step plasma beta profile. Generalizations of the standard equilibrium formulas are given. Author (NSA)

N76-31005# Michigan Univ., Ann Arbor. Dept. of Nuclear Engineering.
THEORETICAL INVESTIGATIONS RELEVANT TO CONTROLLED FUSION RESEARCH Progress Report, 31 Jan. 1975 - 31 Jan. 1976
T. Kammash Jan. 1976 7 p refs
(Contract AT(11-1)-1478)
(COO-1478-14) Avail: NTIS HC $3.50

The main research effort was directed at two major categories of problems associated with plasma confinement in mirror machines and Tokamaks. In the latter case the emphasis was on the effect of runaway electrons on the overall stability of the system while for the open-ended devices much of the effort went into examining the impact of finite beta and feedback stabilization on loss cone modes as well as some investigations in the reactor aspects of mirror confined plasmas. The highlights of these studies along with some of the results are described. NSA

N76-31006# Oak Ridge National Lab., Tenn.
IMPURITY BEAM-TRAPPING INSTABILITY IN TOKAMAKS
T. J. Hogan and H. C. Howe 1976 23 p refs Presented at the 2d Intern. Conf. on Surface Effects in Controlled Fusion Devices, San Francisco, 16 Feb. 1976 Sponsored by ERDA
(CONF-760209-12) Avail: NTIS HC $3.50

The sensitivity of neutron energy production to the impurity trapping of injected neutral beams is considered. This process is affected by inherent low-Z contamination of the tritium preheat plasma, by the species composition of the neutral beam, and by the entrance angle of the beam. The sensitivities of the process to these variables, and to the variation of wall material are compared. One finds that successful use of a low-Z, low-sputtering material can appreciably lengthen the useful pulse length. Author (NSA)

N76-31007# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
SIMULATION OF PARAMETRIC INSTABILITY EFFECTS IN A BEAM PLASMA SYSTEM Ph.D. Thesis
R. F. Hubbard Dec. 1975 231 p refs
(Contract AT(11-1)-2059; Grant NSF GA-31676)
(COO-2059-51) Avail: NTIS HC $8.00

An energetic electron beam produces large amplitude resonant plasma oscillations which can parametrically decay into growing nonresonant electron and ion waves if ion dynamics are included. A similar parametric instability occurs in a plasma driven by a high frequency external electric field. A two specie particle simulation study of beam generated parametric instabilities is presented and the results compared with corresponding one specie beam and external field simulations. For low beam densities the individual nonresonant modes grow approximately at the rates predicted by parametric instability theory. This growth eventually causes the resonant plasma oscillations to decay exponentially at a rate proportional to the original parametric growth rate. NSA

N76-31008# California Univ., Livermore. Lawrence Livermore Lab.
CONTROL OF FIRST-WALL SURFACE CONDITIONS IN THE 2XIIB MAGNETIC MIRROR PLASMA CONFINEMENT EXPERIMENT
T. C. Simonen, R. H. Bulmer, F. H. Coensgen, W. F. Cummins, C. Gormezano, B. G. Logan, A. W. Molvik, W. E. Nexsen, W. C. Turner, B. W. Stallard et al 2 Feb. 1976 20 p refs Presented at the 2d Intern. Conf. on Surface Effects in Controlled Fusion Devices, San Francisco, 16 Feb. 1976
(Contract W-7405-eng-48)
(UCRL-77796; Conf-760209-3) Avail: NTIS HC $3.50

The control of first wall surface conditions in the plasma confinement experiment is described. Before each plasma shot, the first wall is covered with a freshly gettered titanium surface. Up to 5 MW of neutral beam power has been injected into 2XIIB, resulting in first wall bombardment fluxes of 10 to the 17th power atoms. cm/2.s/1 of 13-keV mean energy deuterium atoms for several ms. The background gas flux is measured with a calibrated, 11-channel, fast atom detector. Background gas levels are found to depend on surface conditions, injected beam current, and beam pulse duration. For our best operating conditions, an effective reflux coefficient of 0.3 can be inferred from the measurements. Experiments with long duration and

high current beam injection are limited by charge exchange; however, experiments with shorter beam duration are not limited by first wall surface conditions. It is concluded that surface effects will be reduced further with smoother walls. Author (NSA)

N76-31009# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
REFLEX: A PROGRAM TO CALCULATE THE SCATTERING BY A PLASMA COLUMN IN A RECTANGULAR WAVEGUIDE
A. P. Benedetti and P. Poli Sep. 1975 31 p refs
(RT/FIMA-(75)3) Avail: ERDA Depository Libraries HC $4.00

The program Reflex calculates the reflection and transmission coefficients of a plasma column placed transversally across a rectangular waveguide, when the probing electric field, that propagates in TE sub 10 mode, is parallel to the axis of the column. Account is taken both of the nonuniform electron density distribution of the plasma and of the glass sleeve, or of any other dielectric material, containing the plasma. The program gives electric fields transmitted and reflected as a function of fixed points in waveguide. NSA

N76-31010# Sandia Labs., Albuquerque, N.Mex.
SPECTROSCOPIC STUDY OF AN ARGON PLASMAJET OUT OF LOCAL THERMODYNAMIC EQUILIBRIUM
P. Ranson and J. Chapelle Jan. 1974 26 p refs Transl. into ENGLISH from J. Quant. Spectrosc. Radiative Transfer (England), v. 14, no. 1, Jan. 1974 p 1-18 Sponsored by ERDA
(SAND-76-6012) Avail: NTIS HC $4.00

The properties of an argon plasmajet seeded with a few percent of hydrogen were studied. At atmospheric pressure, significant deviations from local thermodynamic equilibrium are shown. The plasma parameters (electron density N/sub e/, temperature T) were determined from the broadening and the absolute intensity of hydrogen lines. The transition probabilities and the broadening parameters (width and shift) of some Al lines between 4000 and 6000 A were measured. Author (NSA)

N76-31011# Princeton Univ., N.J. Plasma Physics Lab.
HEATING OF PLASMA IN THE TM-3 TOKAMAK AT THE RESONANCE WITH MAGNETIC FIELDS UP TO 25 kOe
V. V. Alikaev, G. A. Bobrovskii, V. J. Pozniak, K. A. Razumova, V. V. Sannikov, Yu. A. Sokolov, and A. A. Shmarin Feb. 1976 15 p refs Transl. into ENGLISH from unidentified Russian Report
(Contract E(11-1)-3073)
(MATT-Trans-120) Avail: NTIS HC $3.50

Plasma heating experiments were conducted in electron cyclotron resonance (ECR) with magnetic fields of up to 25 kOe. It was shown, using laser diagnostics that during the electron cyclotron heating the temperature of the main electron component grows in accordance with the classical heating mechanism of ECR. The radial electron temperature distribution was measured. The relationship between the energy confinement time in the tokamak and the electron temperature was obtained, and the magnitude of the energy confinement time of the accelerated electrons as a function of their energy was evaluated. Using ECH, the value beta sub I approximately 2.2 was obtained for low current discharges. Author (NSA)

N76-31012# Princeton Univ., N.J. Plasma Physics Lab.
SUPPRESSION OF HEAVY IMPURITIES IN THE ST TOKAMAK
E. Meservey, N. Bretz, D. Dimock, and E. Hinnov Dec. 1975 6 p refs
(Contract E(11-1)-3073)
(MATT-1175) Avail: NTIS HC $4.00

Two different discharges in the ST Tokamak are described: a discharge dominated by high-Z (iron) impurity (Case A), and one dominated by low-Z (oxygen) impurity (Case B). The oxygen dominated discharge shows higher electron temperature and longer containment time than the iron-dominated discharge. Suppression of Fe and Mo impurities has been achieved by pulsing in air for a few hundred shots. Author (NSA)

N76-31013# Ecole Polytechnique Federale de Lausanne (Switzerland). Centre de Recherches en Physique des Plasmas.
RESIDUAL PLASMA IN A STRAIGHT PINCH [LE PLASMA RESIDUEL DANS UNE STRICTION AZIMUTALE DROITE]
P. Hafner Oct. 1975 98 p refs In FRENCH; ENGLISH summary
(LRP-97/75) Avail: NTIS HC $5.00

The evolution of the electron density in the outer regions of a fast theta pinch was measured by means of a laser interferometer. The measurements are compared with numerical calculations using a one-dimensional, three-fluid MHD code. Comparison shows that the tenuous plasma in the outer regions originates from an instability during the implosion phase of the pinch. Author (ESA)

N76-31014# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
CRITICAL IONIZATION VELOCITY AND ELECTROSTATIC INSTABILITIES
M. A. Raadu Dec. 1975 21 p refs Sponsored by the Swed. Atomic Res. Council
(TRITA-EPP-75-28) Avail: NTIS HC $3.50

The critical ionization velocity introduced by Alfven was developed along lines initiated by Sherman in order to find an estimate of the energy distribution between ions and electrons in the linear regime and, by extrapolation, obtain an estimate of the maximum expected electron energy when account is taken of the two stream instability effects. It is shown that there exists a range of modes for which electrons can gain high energies although progressively more energy goes into the ions for modes with propagation vectors approaching the perpendicular to the magnetic field. All modes can be expected to occur simultaneously. Those with large effective mass giving most energy to the ions could in principle switch off the instability for the others through the resulting spread in ion velocity. However the time scales involved do not prevent the growth of modes leading to high electron energies. ESA

N76-31015# Ecole Polytechnique Federale de Lausanne (Switzerland). Centre de Recherches en Physique des Plasmas.
THE m = 1 MOTION OF A SCREW PINCH MEASURED BY EXTERNAL MAGNETIC PROBES
A. Pochelon and R. Keller Jun. 1976 18 p refs Sponsored by the Swiss Natl. Sci. Found.
(LRP-99/76) Avail: NTIS HC $3.50

Measurements of the m = 1 growing mode of a linear screw pinch by external dipole probes were compared with the recorded plasma motion on streak photographs. Good agreement was found up to a maximum amplitude which depends on plasma density and growth rate. Author (ESA)

N76-31016# Royal Inst. of Tech., Stockholm (Sweden). Dept of Plasma Physics.
INJECTION OF A PLASMA INTO A TRANSVERSE MAGNETIC FIELD
L. Lindberg Jan. 1976 20 p refs
(TRITA-EPP-76-01) Avail: NTIS HC $3.50

A conical theta pinch was used to inject plasma into a transverse magnetic field. A flow with good reproducibility was obtained, with density 10 exp 18 to 19 per cubic meter, velocity 200 to 400 km/s, and duration 10 microseconds in a field of 0.02 T. The influence of reverse deflection of the beam earlier observed when injecting plasma into a curved field is reduced by making the transition region from longitudinal to transverse field short. Author (ESA)

N76-31017# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
ELECTRON OSCILLATIONS OF A HOT COLLISIONLESS PLASMA IN A STATIC ELECTRIC FIELD
Christer Wahlberg Feb. 1976 115 p refs
(TRITA-EPP-76-03) Avail: NTIS HC $5.50

In the collisionless limit a static electric field influences the electron oscillations only indirectly through the nonuniformity that necessarily is present. Discussion on the propagation of small amplitude disturbances in slowly varying nonuniformities (compared to the wavelength) predominates although an example of scattering in a strong nonuniformity is briefly described. By means of a Riemann-Green function, an exact solution in the special

case of a stationary plasma and a constant static electric field is given and it is shown that the solution found by use of Whitham's method can be identified as the first term in an asymptotic expansion of the exact solution. Explicit expressions for group velocity, amplitude, and energy density as functions of traversed potential drop and frequency for small amplitude localized disturbances, as well as for continuous constant frequency perturbations, are given. Possible applications and extensions are considered. Specifically, possible stability properties of a configuration that involves a stream of energetic electrons interacting with a background of thermal electrons in the presence of a static electric field are discussed. Author (ESA)

N76-31018# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
A NOTE ON THE PROBLEMS OF PLASMA-NEUTRAL GAS INTERACTION
B. Lehnert 21 Feb. 1976 14 p refs
(TRITA-EPP-76-05) Avail: NTIS HC $3.50

The presence of an immersed neutral gas affects the equilibrium and the instability and wave phenomena of magnetically confined plasmas. Attention is drawn to some areas for further research on plasma-neutral gas interaction, including the spatial distributions of plasma and neutral gas, relaxation times, constraints and limitations of gas blanket systems, interaction with radiation, oscillations and wave phenomena, and instabilities. Author (ESA)

N76-31019# Naval Research Lab., Washington, D.C.
MARGINAL STABILITY CALCULATION OF ELECTRON TEMPERATURE PROFILES IN TOKAMAKS Interim Report
Wallace M. Manheimer, K. R. Chu, Edward Ott, and Jay P. Boris Feb. 1976 14 p refs
(AD-A023140; NRL-MR-3248) Avail: NTIS CSCL 20/9

Electron temperature profiles, turbulence levels and anomalous transport are calculated for Tokamak discharges using the hypothesis that the dissipative trapped electron instability drives the plasma to marginal stability. Author (GRA)

N76-31020# California Univ., Los Angeles. Plasma Physics Group.
SOLITON-LIKE STRUCTURES IN PLASMAS
Y. C. Lee and G. J. Morales Mar. 1976 24 p refs
(Contract N00014-75-C-0476)
(AD-A021979; PPG-256) Avail: NTIS CSCL 20/9

Studies of the generation of soliton-like structures in plasmas lead to a class of nonlinear wave equations in which an external source plays a key role. Several related problems are briefly discussed with the hope of stimulating further work on this important topic by the applied mathematics community. Author (GRA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N76-31021 Maryland Univ., College Park.
EXPERIMENTAL INVESTIGATION OF PRESSURE-INDUCED PHASE TRANSFORMATIONS OF COMPOUNDS AND ALLOYS Ph.D. Thesis
Cheng-yih Liu 1975 148 p
Avail: Univ. Microfilms Order No. 76-18698

Pressure-induced structural phase transformations have been investigated in the diamond-anvil cell with X-ray diffraction techniques. Three groups of materials were examined: (1) MoS2, a layered compound; (2) TeO2 which has recently been reported to show phonon softening associated with a second-order transition at 9 Kb; and (3) SbGa(x)In(1-x) alloys which exhibit a first-order structural transformation from a semiconducting to a metallic state. The powder diffraction patterns show that MoS2 assumes the same structure up to about 50Kb, i.e., no structural transformation in this pressure range. Both single-crystal and powder sample X-ray work carried out on TeO2 have clearly revealed that the transformation is from a tetragonal to an orthorhombic phase, is reversible, and occurs at 8 + or - 1Kb. The semiconductor-to-metal transition of the third set of alloys has been verified as a structural transition from the cubic zinc-blende to the tetragonal beta Sn type structure with a large volume reduction of about 20%. Dissert. Abstr.

N76-31022 Pennsylvania State Univ., University Park.
AN ULTRASONIC STUDY OF THE SUPERCONDUCTING ENERGY GAP OF TANTALUM Ph.D. Thesis
Allen C. Boyer 1975 72 p
Avail: Univ. Microfilms Order No. 76-17148

Ultrasonic attenuation measurements were made using specimens cut from three high purity tantalum single crystals. The high purity was needed to assure a long electronic mean free path, l. High frequency sound waves ranging from 180 to 500 MHz were transmitted through the specimen. The long electronic mean free path coupled with the large sonic wave number, q, resulted in a ql > 1 and increased the probability of observing anisotropy in the energy gap along different crystal axes. The high symmetry (100), (110) and (111) axes were selected for investigation since they were less inclined to introduce shear components into the longitudinal wave used. The three single crystals used had resistivity ratios of 400, 2,375 and 3,866. Results of the investigation show that the energy gap anisotropy along the (100), the (110) or the (111) axes of Ta to be of the order of 5% or less. Dissert. Abstr.

N76-31023 Pennsylvania State Univ., University Park.
NONDESTRUCTIVE ELECTRON PROBE FOR COMPOSITIONAL DEPTH PROFILING OF THIN SURFACE LAYERS Ph.D. Thesis
Yaw-Nan Chen 1975 147 p
Avail: Univ. Microfilms Order No. 76-17875

A variable accelerating technique for electron microprobe analysis is developed for the nondestructive composition depth profiling of thin surface layers. The correctional formulas concerning X-ray intensity ratios for a nonhomogeneous specimen were theoretically studied. A set of nonlinear equations were established wherein the atomic effect and absorption correction were introduced but the secondary fluorescence factor was neglected. A computer program written in FORTRAN 4 was developed to solve the compositional depth profiling functions. Calibrated standard specimens were prepared by carefully controlled sputter coating of silver and nickel to form in all, six compositionally graded films. The results indicate that the predicted compositional functions coincide with real compositions in shape and contour and only 5 percent to 10 percent relative deviations were observed. Dissert. Abstr.

N76-31024 Virginia Univ., Charlottesville.
SUPERCONDUCTING WEAK LINKS FORMED BY ION IMPLANTATION Ph.D Thesis
Charles Hammond Arrington, III 1975 82 p
Avail: Univ. Microfilms Order No. 76-18086

Superconducting weak links exhibiting the Josephson effects have been formed for the first time by implanting small amounts of various ions into a narrow line across thin-film niobium strips. The experimental methods involved in producing these weak links are described as well as the various characteristics of the links and the effects of different types and amounts of ions. The theory behind the implantation of impurities into superconductors is discussed, and a possible model for the behavior of weak links of this type is considered. Dissert. Abstr.

N76-31025 Ohio State Univ., Columbus.
NU SUB 2 AND NU SUB 3 BANDS OF OZONE Ph.D. Thesis
Yan-shek Hoh 1976 186 p
Avail: Univ. Microfilms Order No. 76-17989

The nu 2 and nu 3 bands of 1603 have been studied by using a 3.5 meter focal length Littrow type vacuum infrared spectrometer equipped with a replica diffraction grating. A technique employing the chemical method based on the reaction of ozone and potassium iodide solution has been systematized and used for determining the concentration of ozone. For the nu 2 band, about 3000 transitions were observed in the spectral region 573 sq cm to 807 sq cm. For the nu 3 band, about 700 transitions were recorded from 977 sq cm to 1972 sq cm.

The observational data have been analyzed with a Watson type reduced Hamiltonian which includes distortion effects. In spite of the Coriolis interaction between nu 3 and nu 2, it has found possible to fit most of the nu 3 observed transitions to a set of effective molecular constants. The determined molecular constants are given in cm/1. Dissert. Abstr.

N76-31026 Ohio State Univ., Columbus.
A STUDY OF QUANTUM DIFFUSION AND MAGNETIC RELAXATION IN SOLID HYDROGEN Ph.D. Thesis
James Elwood Kohl 1976 134 p
Avail: Univ. Microfilms Order No. 76-998

Conventional pulse NMR techniques were applied to the study of non-random alloys of .88 percent o-H2 in p-H2. The alloys were prepared by maintaining the sample temperature at .58, .40 or .12K for 100 hours. The o-H2 molecules tended to cluster by diffusing through the crystal, presumably by a quantum process. The characteristic time constants associated with this clustering were measured as a function of temperature. At equilibrium, the free induction decay observed could be decomposed into several parts. Each of the several parts were presumably due to isolated o-H2 molecules or nearest o-H2 neighbors forming pairs, triangles or larger clusters. In addition to the observation of the free induction decays, an att mpt was made to measure the thermal relaxation associated with the several components of the free induction decay. Dissert. Abstr.

N76-31027 Washington Univ., Seattle.
GUIDED ACOUSTOOPTIC INTERACTION IN THIN FILMS Ph.D. Thesis
Koon Whye Loh 1975 202 p
Avail: Univ. Microfilms Order No. 76-18424

The guided acoustooptical interaction (AO) in GaAs and LiNbO3 was investigated. For GaAs, the AO interaction was investigated at 1.5 micrometers on the entire (100) plane as a function of waveguide thickness, type of mode, acoustic frequency, direction of acoustic wave propagation, and substrate refractive index. Results indicate that best efficiency is obtained for te sub o approaches (te sub o) ogw and for acoustic surface wave propagating along the <011> direction at a waveguide thickness close to cutoff. Approximately 75 mW of acoustic power is required for 100 percent diffraction. For LiNbO3, the AO interaction was investigated for the YZ cut orientation at 0.6328 micrometer as a function of delta n (difference in index of refraction between the film and substrate). Results reveal that the diffraction efficiency can be optimized in different frequency regions by controlling delta n. The acoustic power required for 100 percent diffraction efficiency is 150 mw for delta n = 0.02 at 200 MHz and is 250 mw for delta n = 0.03 at 1 GHz. Dissert. Abstr.

N76-31028 Maryland Univ., College Park.
SMALL-ANGLE CRITICAL MAGNETIC NEUTRON SCATTERING FROM COBALT Ph.D. Thesis
Charles Joseph Glinka 1975 158 p
Avail: Univ. Microfilms Order No. 76-17796

Detailed measurements were made of the small-angle scattering of neutrons from cobalt in the vicinity of its Curie temperature, T sub c. Through the use of total and inelastic scattering techniques, both the small wave vector and low frequency dependence of the scattering function in the critical region were determined. Below T sub c the scattering is dominated by well-defined spinwave modes which exhibit nearly quadratic dispersion. A simple generalization of hydrodynamic expressions for the spin-wave cross-section gives a satisfactory description of observed line shapes at all temperatures below T sub c. Above T sub c, the angular distributions of the critical scattering are found to be well described by the Ornstein-Zernike form for the reduced wave-vector-dependent susceptibility after taking full account of the inelasticity of the scattering. The results obtained are compared with predictions of the theories of static and dynamic scaling as well as with calculations of critical properties based on the Heisenberg and Ising models. Dissert. Abstr.

N76-31029 Washington Univ., Seattle.
ELECTRON SURFACE STATES AND THE CLASSICAL ELECTRON GAS Ph.D. Thesis
John Vlastislav Chalupa 1975 136 p
Avail: Univ. Microfilms Order No. 76-17423

If a positively charged plate is placed below the surface of liquid neon, an electron near the liquid will become localized in the vicinity above the surface. A large number of such bound electrons come to thermal equilibrium and constitute a thermodynamic many body system. At low surface electron density and typical neon temperatures a many electron surface state behaves like a nearly ideal classical gas. Two models of this dilute high temperature many electron system are analysed. In the first model, it is assumed that the electrons form a monolayer above the neon surface and act like a two dimensional gas. In the second model, the assumption that the electrons constitute a monolayer on the neon surface is examined by drodynamically. It is shown that the electrons form a diffuse layer rather than a monolayer; they act like a three dimensional inhomogeneous gas localized near the neon surface. Dissert. Abstr.

N76-31030 Stanford Univ., Calif.
NINE GIGAHERTZ IMPEDANCE PROPERTIES OF POINT-CONTACT JOSEPHSON JUNCTIONS Ph.D. Thesis
David Earl Claridge 1976 217 p
Avail: Univ. Microfilms Order No. 76-18755

The complex RF impedance of tantalum point contact Josephson junctions has been measured at a frequency of 8.9 GHz. The impedance was measured at a frequency of 8.9 as a function of the dc bias current for a range of values of the RF current amplitude. Measurements were made for various values of I sub RF in the range 0.051 I sub m approximately less than I sub RF approximately less than 10 I sub m. For dc bias currents in the range zero less than or equal to I sub zero less than or equal to I sub mRF (where I sub mRF is the maximum zero voltage current in the presence of I sub RF), the real part of the normalized impedance r sub RF increases monotonically while the imaginary part x sub RF is inductive and decreases monotonically. As I sub zero is increased, the impedance remains basically constant until the dc bias voltage nears the voltage of the first Josephson step. Then rapid changes occur in the impedance. Dissert. Abstr.

N76-31031 Maryland Univ., College Park.
AN INVESTIGATION OF THE NU/SUB 3, NU/SUB 1, AND 2 NU/SUB 4 VIBRATION-ROTATION BANDS OF AMMONIA, ND3 Ph.D. Thesis
James Max Krell 1975 126 p
Avail: Univ. Microfilms Order No. 76-18821

In examining the bands of the fundamental vibrations of this molecule it is immediately obvious that several complications obscure the analysis of the spectrum. First the normal coordinate problem for the ammonia molecule is considered. The symmetry considerations relevant to the molecule are then presented, and a classification of the vibration-rotation wave functions of ammonia is carried out under the full molecular point group. The energies of the molecule are discussed along with the nature of the molecular Hamiltonian. The assignment and analysis of the experimental spectrum is presented along with linear regression calculations for the four major bands that are considered. It is readily apparent that linear regression calculations are completely insufficient in the reproduction of the spectrum to the estimated experimental accuracy. Finally, a nonlinear regression calculation is discussed along with a consideration of the nature of the matrix elements of the Hamiltonian to be included in such a calculation. Dissert. Abstr.

N76-31032 Columbia Univ., New York.
EMITTANCE OF THIN METALLIC FILMS AT CRYOGENIC TEMPERATURES Ph.D. Thesis
Charles Harry Forsberg 1976 381 p
Avail: Univ. Microfilms Order No. 76-18466

The thermal radiation properties (i.e., emittance of absorptance, reflectance, and transmittance) of thin metallic films and metal-coated dielectric films at cryogenic temperatures was investigated. Knowledge of such properties is of major importance due to use of these films in a variety of applications, including multilayer insulations and spacecraft thermal control surfaces. Both theoretical and experimental determinations of the thermal radiation properties of these films are considered. In the theoretical portion of the work, the properties of a single metallic film were obtained through the numerical solution of the governing

integrodifferential equation for the anomalous skin effect theory with size effects included. The experimental portion of the work dealt with the design and construction of an experimental apparatus used to determine the radiation emitted by an aluminum film from commercially-available multilayer insulation. The results of the experimental investigation are presented and compared with the results obtained by other researchers. Dissert. Abstr.

N76-31033 Lowell Technological Univ., Mass.
CUTOFF THEORY OF IMPACT BROADENING AND SHIFT Ph.D. Thesis
Richard Paul Leavitt 1976 127 p
Avail: Univ. Microfilms Order No. 76-16862

An impact theory of pressure broadening and shift of rotation-vibration lines using a natural cutoff is described. The theory is based on Anderson's theoretical framework and employs an exponential expansion of the collision matrix elements derived using a linked cluster theorem for degenerate states. The final expression for the interruption function is similar in form to Gordon's classical interruption function. Closed form expressions for the broadening and shift cross sections are given for exactly resonant dipole-dipole collisions, and a calculation of the HCl self-broadening in the 0-2 vibrational band is given.
Dissert. Abstr.

N76-31034 Tennessee Univ., Chattanooga.
SHAPE EFFECTS IN THE ELASTIC AND INELASTIC SCATTERING OF 70.4 MeV C-12 IONS FROM THE EVEN NEODYMIUM ISOTOPES Ph.D. Thesis
Donald Lee Hillis 1976 282 p
Avail: Univ. Microfilms Order No. 76-17725

The interference of Coulomb and nuclear excitation is studied by the scattering of 70.4 MeV C-12 ions from the even Nd nuclei. The differential cross sections for elastic scattering and inelastic scattering from the low lying 2+, 4+, 3-, and 2(2)+ states of these isotopes were obtained along with the cross sections of the 2+(4.4MeV) state of the projectile C-12 and the 6+ state in Nd-150. Coulomb and Nuclear excitation of the 2+ states in these targets produce rather smooth angular distributions, but for the 3- and 4+ states rather pronounced interference minima are present. The angular distributions are analyzed under the assumptions of the rotational model for the nucleus and a deformed optical model interaction between the C and Nd nucleus by solving the resulting coupled equations. The analysis reveals the importance in heavy ion reactions of multistep processes, such as reorientation as manifested through the static quadrupole moments of the excited states and mulitple excitation of states via lower lying excited states. Dissert. Abstr.

N76-31035 Connecticut Univ., Storrs.
SPACE CHARGE CAPACITANCE OF ASYMMETRICAL p-n JUNCTIONS Ph.D. Thesis
Gobind Hashmatrai Atmaram 1976 122 p
Avail: Univ. Microfilms Order No. 76-18982

The theoretical treatment of the capacitance of the reversebiased, asymmetrical p-n junctions is conventionally based on the assumption that the dopant concentration changes abruptly at the metallurgical junction. An analysis was performed which predicted that the plot of inverse square capacitance versus the applied voltage was a straight line with intercept V sub O on the voltage axis. Measurements on the alloyed junction diodes and shallow-diffused diodes indicated that the experimental value of V sub O was smaller than the one predicted by the theory based on the abrupt-junction approximation. This indicates that the accurate theoretical prediction of the diode capacitance is not possible by the existing methods. Discrepancies between the theoretical and experimental values were explained by the lack of junction abruptness, resulting from the solid-state diffusion during diode fabrication. A modified semi-analytical method was derived to calculate the capacitance of reverse-biased asymmetrical junctions, and it was concluded that more accurate values of the diode capacitance prior to device fabrication can be predicted by the method. Dissert. Abstr.

N76-31036 Cornell Univ., Ithaca, N.Y.
THE CONTROLLED GROWTH OF THIN GaAs LAYERS BY LIQUID PHASE EPITAXY FOR MICROWAVE FIELD EFFECT TRANSISTORS Ph.D. Thesis
Hadis Morkoc 1976 241 p
Avail: Univ. Microfilms Order No. 76-18173

The bottom-of-the-melt transient mode liquid phase epitaxial growth method has been successfully used to provide GaAs submicron layers with parameters suitable for microwave field effect transistors and relatively thicker layers for Gunn logic devices on semi-insulating substrates in the temperature range of 800-700 C. By the introduction of a source-seed crystal, precise saturation of the melt has been obtained. The difficulties in getting uniform wetting have been overcome by growing a porous and amorphous oxide layer and stripping it off in 50 percent aqueous HCl immediately before it is loaded into the reactor. Numerical methods together with the introduction of the temperature dependence of the As diffusion coefficient in Ga solution have been employed to calculate the As concentration profile growth rate and thickness in a temperature range of 700-800 C. Very close agreement between the theory and the experiments in the growth of submicron layers has been achieved. Dissert. Abstr.

N76-31037 Michigan Univ., Ann Arbor.
A TWO-DIMENSIONAL SIMULATION OF MESFETs Ph.D. Thesis
Johny Joe Barnes 1976 232 p
Avail: Univ. Microfilms Order No. 76-19075

The performance limitations of GaAs metal semiconductor field-effect transistors (MESFET) were investigated, and methods to improve the present performance of these devices were determined. The diffusion current mechanism is included in the simulation. By using a full two-dimensional device simulation the operation of the MESFET was obtained subject to the limitations of the device processing parameters and the validity of the form of the transport equation model. It is shown that the drain current may be increased by placing a lower doped region between the gate and the drain of the MESFET where the highest field exists, since drift velocity saturation degrades the device performance. Furthermore the 0.4-micron gate length GaAs MESFET was shown to exhibit a negative-resistance region in the drain current characteristic. The equation formulation and extension to the Hermite bicubic shape function are described as well as the associated choices for the time evolution scheme. Dissert. Abstr.

N76-31038 Tennessee Technological Univ., Cookeville.
OVONIC SWITCHING IN TIN SELENIDE THIN FILMS Ph.D. Thesis
Charles Ronald Baxter 1974 132 p
Avail: Univ. Microfilms Order No. 76-17272

Amorphous tin selenide thin films which possess Ovonic switching properties were fabricated using vacuum deposition techniques. Results obtained indicate tha memory type Ovonic switching does occur in these films with the energy density required for switching from a high impedance to a low impedance state being dependent on the spacing between the electrodes of the device. There is also a strong implication that the switching is a function of the magnitude of the applied voltage pulse. A completely automated computer controlled testing procedure was developed which allows precise control over the shape of the applied voltage switching pulse. Dissert. Abstr.

N76-31039 Stanford Univ., Calif.
SECOND ORDER NONLINEAR OPTICAL PROCESSES IN SEMICONDUCTORS Ph.D. Thesis
Michael Muk Choy 1976 125 p
Avail: Univ. Microfilms Order No. 76-18754

Theoretical and experimental studies of optical nonlinear interactions in semiconductors are reported. The second order susceptibility for tetrahedral compounds is calculated using the bond orbital model. The model clearly displays the physical origin of the second order nonlinear susceptibility. The model leads to a rule of thumb estimate of the relative magnitudes of the nonlinear susceptibility from a knowledge of the position of constituent elements in the periodic table. The wedge technique was used to accurately intercompare the second order susceptibilities of GaAs, GaP, CdSe, AgGaSe2, LiNbO3, LiIO3 and KDP. The absolute values of the susceptibilities of LiIO3 and LiNbO3 at 4880 and 5145 A were also determined. Thus, for the first time, an accurate scale of susceptibility values is established

relative to LiIO3(d31) that extends from the visible to the infrared. Dissert. Abstr.

N76-31040 Pennsylvania State Univ., University Park.
THE PREPARATION AND CHARACTERIZATION OF CARBIDE CONTAINING SAMPLES TO STUDY VORTEX PINNING IN SUPERCONDUCTING VANADIUM Ph.D. Thesis
Roy Lewis Schuyler, III 1975 100 p
Avail: Univ. Microfilms Order No. 76-17219

Samples of 99.95 percent pure vanadium were annealed under vacuum, carburized to either 0.3 atomic percent or 0.9 atomic percent carbon and radiation cooled. The samples were aged for times of up to five hours to obtain specimens containing different size and volume fractions of normally conducting vanadium carbide precipitates. The precipitate particles obtained by aging for 0, 30, 60, 120 and 300 minutes in samples containing 0.3 atomic percent carbon were characterized with respect to mean particle diameter by analysis of transmission electron micrographs. Histograms were constructed for each treatment to show the distribution of particle diameters. An empirical expression relating the thickness of a precipitate particle to its diameter was obtained from a graph of particle diameter versus particle thickness squared for samples containing 0.3 atomic percent carbon. Dissert. Abstr.

N76-31041*# Old Dominion Univ. Research Foundation, Norfolk, Va.
EXCITON COUPLING IN MOLECULAR CRYSTALS Final Report, 1 Feb. 1971 - 31 Jan. 1975
Robert L. Ake Aug. 1976 15 p refs
(Grant NGR-47-003-048)
(NASA-CR-148722) Avail: NTIS HC $3.50 CSCL 20B

The implications of perfect exciton coupling and molecular vibrations were investigated, as well as the effect they have on the lifetime of singlet and triplet excitons coupled in a limiting geometry. Crystalline bibenzyl, Cl4Hl4, provided a situation in which these mechanisms involving exciton coupling can be studied in the limit of perfect coupling between units due to the crystal's geometry. This geometry leads to a coupling between the two halves of the molecule resulting in a splitting of the molecular excited states. The study reported involves an experimental spectroscopic approach and begins with the purification of the bibenzyl. The principal experimental apparatus was an emission spectrometer. A closed cycle cryogenic system was used to vary the temperature of the sample between 20 K and 300 K. The desired results are the temperature-dependent emission spectra of the bibenzyl; in addition, the lifetimes and quantum yields measured at each temperature reveal the effect of competing radiationless processes. Author

N76-31042# Rockwell International Corp., Anaheim, Calif. Autonetics Group.
CHARACTERISTICS OF POWER TRANSIENTS IN NEUTRON AND IONIZING RADIATION ENVIRONMENTS
C. E. ONeil and A. J. Chesavage 2 Mar. 1976 10 p refs Presented at Electro 76 Conf., Los Angeles, Calif.
(X76-226/501) Avail: NTIS HC $3.50

The effects of neutron and ionizing radiation on power transistors are studied. In most electronic systems, power transistors are the most susceptible to these environments. An understanding of the mechanisms involved and predictability based on electrical characteristics permit optimum tradeoffs for a radiation hard design. Author

N76-31043# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
IR WINDOW STUDIES Final Report, 1 Sep. 1974 - 31 Aug. 1975
Ferdinand A. Kroger and John H. Marburger Sep. 1976 136 p refs
(Contract F19628-75-C-0080; ARPA Order 2055; AF Proj. 5621)
(AD-A022828; AFCRL-TR-75-0623) Avail: NTIS CSCL 17/5

This document describes the results of a variety to studies of IR window materials and systems performed at the University of Southern California during 1974-75. The studies fall under three categories: (a) IR window material characterization, (b) IR window failure mechanisms, and (c) window system evaluation. Projects under A include applications of scanning cathodoluminescence microscopy, thin foil transmission electron microscopy, and IR absorption spectroscopy to window materials characterization. Emphasis was on semiconductor materials, including ZnSe, CdTe and GaAs. Measurements of strain optic coefficients were performed on GaAs, and the temperature and frequency dependence of the refractive index of ZnSe was determined precisely. A surface acoustical wave technique for distinguishing between bulk and surface absorption was perfected and applied to uncoated KCl window samples. GRA

N76-31044# Atomic Energy Research Establishment, Harwell (England).
RADIATION DAMAGE IN DIATOMIC MATERIALS AT HIGH DOSES
L. W. Hobbs and A. E. Hughes Oct. 1975 27 p refs Presented at the 77th Ann. Meeting of the Am. Ceram. Soc., Washington, D. C., 3 May 1975 Sponsored by ERDA
(AERE-R-8092; Conf-750542-8) Avail: NTIS Avail: ERDA Depository Libraries HC $4.00

Radiation effects in diatomic materials can differ structurally from those in metals because of the need to take into account different displacement rates on the two sublattices and the inevitable stoichiometric implications; in most diatomic insulators the anion species has the greater displacement cross section. Anion point defect stabilization in heavily irradiated (0.1-10 dpa) diatomic insulators has been studied using radiolysis of alkali and alkaline earth halides. At temperatures > 0.3 T sub m, all anion defects are mobile and can aggregate. Aggregation of anion interstitials results in creation of perfect dislocation loops without the need for primary cation displacements; simultaneous formation of substitutional anion molecular centers provides the necessary cation interstitials. Aggregation of anion vacancies leads to formation of metallic inclusions of the cation species, in some cases in an ordered array, which is the analogue, on a single sublattice, to the void lattice in metals. NSA

N76-31045# Instituto de Energia Atomica, Sao Paulo (Brazil).
DAMAGE PRODUCTION BY FAST ELECTRONS IN DILUTE ALLOYS OF VANADIUM, NIOBIUM AND MOLYBDENUM
P. Jung and G. Lucki Apr. 1975 16 p refs Sponsored by ERDA
(IEA-391) Avail: NTIS Avail: ERDA Depository Libraries HC $3.50

Vanadium, niobium, and molybdenum samples containing about 300 ppm of zirconium were irradiated at helium-temperature with electrons of energies between 0.6 and 3.1 MeV. The measured damage rates were analyzed in terms of minimum threshold energy, damage function, and resistivity per unit concentration of Frenkel pairs. For the minimum threshold energy T sub d, values of 25 + or - 2 eV (V), 28 + or - 2 eV (Nb) and 34 + or - 2 eV (Mo) were obtained. Pronounced differences between the displacement functions of molybdenum and that of niobium and vanadium are found which are explained by different stability of the defects during the irradiation at helium temperature. Author (NSA)

N76-31046# Istituto Superiore di Sanita, Rome (Italy).
MAGNETIC BEHAVIOR OF FIRST KIND SUPERCONDUCTING FILMS IN THE INTERMEDIATE THICKNESS REGION
A. Rogani and E. Tabet 10 Jun. 1975 21 p refs
(ISS-P-75/7) Avail: ERDA Depository Libraries HC $3.50

The Ginzburg-Landau equations are solved for first kind superconducting films for thicknesses equal to or greater than the coherence length. Now the knowledge of the order parameter allows calculation of the parallel critical fields H sub cF as a function of temperature and specimen thickness. Finally the theoretical values for H sub cF are compared with the existing experimental data for tin films at various temperatures and thicknesses. Author (NSA)

N76-31047# AEG-Telefunken, Frankfurt am Main (West Germany).
FABRICATION AND INVESTIGATION OF ION IMPLANTED IV-VI SEMICONDUCTOR ALLOYS FOR INFRARED DETECTORS AND SEMICONDUCTOR LASERS Final Report [HERSTELLUNG UND UNTERSUCHUNG VON IONENIM-

PLANTIERTEN IV-VI-HALBLEITER-MISCHKRISTALLEN FUER INFRAROTDETEKTOREN UND HALBLEITERLASER]
Horst Maier Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1975 90 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-75-48) Avail: NTIS HC $5.00; ZLDI, Munich DM 18,90

Ion implantation proved to be a powerful method to produce p-n junctions for infrared devices from the binary lead chalcogenides PbS and PbTe. Its extension to pseudobinary alloys like Pb(1-y)Sn(y)Se with an active wavelength range in the third atmospheric window (8-14 micron) was investigated. A modified sublimation growth yielded near perfect crystals up to 1 cm edge length. The technological procedures for planar diode arrays were developed and the annealing process of the implantation damage was studied. Contrary to the binary lead chalcogenides, the Na, Se, Sb ion implanted alloys with smaller band gap proved very unstable and their reverse bias characteristics did not reach the standard known from epitaxial diodes. Author (ESA)

N76-31048# California Univ., Berkeley. Electronics Research Lab.
RESEARCH ON ELECTRONIC INTERACTION WITH SURFACE AND BULK ELASTIC WAVES Final Report, 15 Sep. 1967 - 30 Sep. 1975
Richard M. White Jan. 1976 6 p refs
(Grants DA-ARO(D)-31-124-G949; DA-ARO(D)-31-124-G1057) (AD-A022387; ARO-5718.15-EL) Avail: NTIS CSCL 20/12

This is a summary of studies of surface elastic waves and devices employing such waves, carried out from 1967 through 1975 under ARO-D sponsorship in the EECS Department, University of California, Berkeley. Author (GRA)

N76-31049# Stanford Univ., Calif. Dept. of Materials Science and Engineering.
TRANSPORT AND LOCALIZED LEVELS IN AMORPHOUS BINARY CHALCOGENIDES Final Report, 1 Nov. 1972 - 31 Oct. 1975
Richard H. Bube, John E. Mahan, Ralph T.-S. Shiah, and Hubert A. VanderPlas Nov. 1975 96 p refs
(Contract DAHC04-73-C-0004)
(AD-A022457; ARO-11001.6-P) Avail: NTIS CSCL 20/12

Detailed measurements have been made on 20 amorphous binary semiconductors for electrical conductivity, photoconductivity, field effect, and thermoelectric power and their temperature dependence. Information is obtained on the density and location of localized states, the mechanism of the transport processes, and the way in which these processes vary with the optical absorption gap and other properties of these materials. Author (GRA)

N76-31050# Illinois Univ., Urbana. Dept. of Physics.
THEORETICAL PROBLEMS IN SOLID STATE AND LOW TEMPERATURE PHYSICS Final Report, 16 Nov. 1973 - 30 Nov. 1975
John Bardeen and John D. Dow Jan. 1976 7 p refs
(Contract DAHC04-74-C-0005)
(AD-A021696; ARO-11807.14-P) Avail: NTIS CSCL 20/3

Areas of research include: (1) theory of vortex motion in pure type II superconductors, (2) nonequilibrium problems associated with current flow across superconducting-normal boundaries, (3) a theoretical model for study of the study of the exciton mechanism for superconductivity consisting of a very thin metallic film on the surface of a semiconductor, (4) theory of enhanced conductivity above the Peierls transition temperature from charge density wave fluctuations in psuedo-one-dimensional conductors and (5) theory of the electronic structure and optical properties of semiconductors, with emphasis on ternary alloys of III-V compounds doped with nitrogen important for light emitting diodes and lasers. Author (GRA)

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N76-31051 Virginia Univ., Charlottesville.
ON THE SIZE-DEPENDENCE OF MELTING TEMPERATURE Ph.D. Thesis
Peter Robert Couchman 1976 189 p
Avail: Univ. Microfilms Order No. 76-18089

The effect of particle size on melting temperature is treated theoretically using the methods of classical thermodynamics. The energetics and physical insight bearing on this problem are discussed thoroughly in order to develop a physically meaningful definition of the melting temperature for these systems. The melting criterion is indicated by the physical discussion as essentially a nucleation and growth criterion. Good overall agreement is found between quantitative predictions and experimental results. Dissert. Abstr.

N76-31052 Columbia Univ., New York.
THERMODYNAMIC PROPERTIES OF SYSTEMS, Cu-Ni-S AND Fe-Cu-Ni-S Ph.D. Thesis
Sang Lyul Lee 1976 170 p
Avail: Univ. Microfilms Order No. 76-18472

The equilibrium partial pressure of sulfur vapor over Cu-Ni-S and Fe-Cu-Ni-S melts was determined at 1,200 C and 1,400 C. The ternary melts, having Ni/Cu atom ratios of 0.334, 1.029 and 3.004 were studied for sulfur concentrations up to the join between Cu2S and Ni3S2. The miscibility gap between molten metal and liquid matte was delineated accurately with respect to composition and equilibrium sulfur pressure. The quaternary melts, having Fe/(Cu+Ni) atom ratios of approximately 0.33, 1.00 and 3.00 and the same Ni/Cu atom ratios as that of the ternary, were studied at sulfur concentrations close to where the solution composition can be expressed in terms of FeS, Cu2S and Ni3S2. The experimental method involved equilibration of the melts with H2/H2S gaseous mixtures in an open flow system; a gas interferometer was used to determine the gas composition and to monitor the approach to equilibrium. Dissert. Abstr.

N76-31053*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CORRELATIONS FOR DETERMINING THERMODYNAMIC PROPERTIES OF HYDROGEN-HELIUM GAS MIXTURES AT TEMPERATURES FROM 7,000 TO 35,000 K
Ernest V. Zoby, Peter A. Gnoffo, and Randolph A. Graves, Jr. Washington Aug. 1976 28 p refs
(NASA-TN-D-8262; L-10741) Avail: NTIS HC $4.00 CSCL 20M

Simple relations for determining the enthalpy and temperature of hydrogen-helium gas mixtures were developed for hydrogen volumetric compositions from 1.0 to 0.7. These relations are expressed as a function of pressure and density and are valid for a range of temperatures from 7,000 to 35,000 K and pressures from 0.10 to 3.14 MPa. The proportionality constant and exponents in the correlation equations were determined for each gas composition by applying a linear least squares curve fit to a large number of thermodynamic calculations obtained from a detailed computer code. Although these simple relations yielded thermodynamic properties suitable for many engineering applications, their accuracy was improved significantly by evaluating the proportionality constants at postshock conditions and correlating these values as a function of the gas composition and the product of freemstream velocity and shock angle. The resulting equations for the proportionality constants in terms of velocity and gas composition and the corresponding simple realtions for enthalpy and temperature were incorporated into a flow field computational scheme. Comparison was good between the thermodynamic properties determined from these relations and those obtained by using a detailed computer code to determine the properties. Thus, an appreciable savings in computer time was realized with no significant loss in accuracy. Author

N76-31054# Addis Translations International, Portola Valley, Calif.
STUDY OF THE SIMPLE SUBSTANCES UNDER HIGH PRESSURES
S. M. Stishov Dec. 1975 52 p refs Transl. into ENGLISH of doctoral dissertation summary Prepared for Lawrence Livermore Lab. Sponsored by ERDA
(UCRL-Trans-10993) Avail: NTIS HC $4.50

Results of studies on the thermodynamic properties of Ar, Na, and Cs are reported. The main laws governing the thermodynamics of melting of these elements were established. Experimental P-V-T data were obtained characterizing the equations of state for the liquid and solid phases of argon, sodium, and cesium at pressures up to 17X10 to the 3rd power Kg per sq cm (Ar), 22 X 10 to the 3rd power Kg per sq cm (Na, Cs), and temperatures up to 75 C (Ar), 220 C (Na), and 200 C (Cs). Thermodynamic functions and their derivatives were calculated for the liquid and solid phases of these elements using empirical equations of state approximating the experimental P-V-T data with good accuracy. Author (NSA)

N76-31055# National Bureau of Standards, Washington, D.C.
A COMPARISON OF TWO MONTE CARLO METHODS FOR COMPUTATIONS IN STATISTICAL MECHANICS Final Report
G. W. Cunningham and P. H. E. Meijer 4 Sep. 1974 15 p refs Repr. from Journal of Computational Physics, vol. 20, no. 1, Jan. 1976 p 50-63 Prepared in cooperation with IBM Federal Systems Div., Gaithersburg, Md.
(PB-252498/1) Avail: NTIS HC $3.50 CSCL 20J

A comparison of two Monte Carlo methods for computations in statistical mechanics is presented. In the comparison, involving a two-state problem, the transition probabilities introduced by Metropolis et al. are compared with the conditional probabilities of the Boltzmann distribution. The analytic relationship between the two is derived. Results of energy computations are given for an ising spin system on a triangular lattice using first one set of transition probabilities then the other. Both results are compared with the exact analytic solution. Greater stability and faster convergence was found when using the conditional Boltzmann probabilities. Also some results for the Monte Carlo method in general are presented. Author (GRA)

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N76-31056 Michigan Univ., Ann Arbor.
A DECISION ANALYSIS APPROACH TO RESOURCE ALLOCATION PLANNING PROBLEMS WITH MULTIPLE OBJECTIVES Ph.D. Thesis
Donald Lee Keefer 1976 247 p
Avail: Univ. Microfilms Order No. 76-16946

A decision analysis approach to resource allocation planning problems having uncertainties, multiple competing objectives, organizational constraints, and continuous decision variables is developed. Applications of the approach to two industrial planning problems--one within a product engineering (design) department and the other within a research and engineering group--are reported in detail. The managers involved in these applications found the approach useful and worth incorporating into their planning activities. Dissert. Abstr.

N76-31057# Rockwell International Corp., Anaheim, Calif. Autonetics Group.
INNOVATIVE WORK MEASUREMENT PROGRAMS: AN ESSENTIAL LINK TO IMPROVED PRODUCTIVITY
J. D. Mitchell 19 Apr. 1976 28 p refs Presented at MTM Assoc. Spring Conf., Los Angeles, Apr. 1976
(X76-388/101) Avail: NTIS HC $4.00

A work measurement program is described, focusing on direct labor performance associated with relatively low production rate, high value hardware, and its relationship with other elements of the overall production management control systems. The new MIL STD 1567 on work measurement is also explored from the viewpoint of interaction and interpretation as related to on-going work measurement programs. Author

N76-31058# RAND Corp., Santa Monica, Calif.
EVALUATING POLICY STUDIES BY USING THE CASE SURVEY METHODS
Robert K. Yin and Karen A. Heald Mar. 1975 22 p refs
(AD-A022181; P-5349) Avail: NTIS CSCL 05/1

A common problem faced in evaluation research is the assessment of existing policy studies. For many reasons, an investigator may be interested in determining 'what the research says' before establishing a framework for testing new hypotheses. Similarly, policymakers often want to know what has already been learned before considering alternative public programs. And, because of the rapid expansion of public service programs during the 1960s and the concomitant policy research efforts, there are now indeed many published and unpublished studies worthy of secondary analysis: manpower and training studies, drug treatment and health care research, studies of educational achievement, research on urban innovations and the application of new technology to social problems, and numerous investigations focusing on public organizations and organizational behavior. GRA

N76-31059# Massachusetts Inst. of Tech., Cambridge. Operations Research Center.
ON THE DESIGN OF HIERARCHICAL PRODUCTION PLANNING SYSTEMS
Gabriel R. Bitran and Arnoldo C. Hax Feb. 1976 42 p refs (Contracts N00014-75-C-0556; N00014-75-C-0661; NR Proj. 347-027)
(AD-A021912; TR-121) Avail: NTIS CSCL 12/2

To provide effective managerial support to the decisions related to the production planning and scheduling processes, it is useful to partition this set of decisions in a hierarchical framework. In the resulting system higher level decisions impose constraints to lower level actions, and lower level decisions provide the necessary feedback to reevaluate higher level actions. The purpose of this paper is to suggest optimum procedures to deal with the resulting subproblems, and to analyze the interaction mechanisms among the different hierarchical levels. Computational results are given. Author (GRA)

N76-31060# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. Dept. of Systems Management.
LARGE SCALE ORGANIZATIONAL ANALYSIS: A PRELIMINARY REPORT ON A COMPUTER-AIDED METHODOLOGY
C. W. McNichols and T. Roger Manley Jan. 1976 67 p
(AD-A022114; AFIT-TR-76-1) Avail: NTIS CSCL 05/1

The report describes a computer based approach to large scale organizational analysis. The methodology was developed in conjunction with a consulting effort in a major air command headquarters with a manning in excess of 5,000 personnel. A model was developed consisting of a three-level hierarchy of tasks, activities, and processes. Data collected throughout the organization using a two stage survey approach provided structured information on what is done in the organization, who does it, who causes it to be done, who sees the results of what is done, what interactions are required, and what manpower resources are consumed. These data were then converted to an automated form. Flexible retrieval software was then developed to allow simple extraction of subsets of the data base, and presentation in useful summaries. The report describes the study objectives, methodology, survey instruments, and retrieval software. GRA

N76-31061# Stanford Univ., Calif. Systems Optimization Lab.
AN OPTIMAL ALGORITHM FOR THE RESOURCE CONSTRAINED PROJECT SCHEDULING PROBLEM
Paul Franklin McCoy Oct. 1975 178 p refs
(Contracts N00014-67-A-0112-0058; F44620-74-C-0079; DAHC04-74-C-0034; AT(04-3)-326; Grant NSF GK-35491)
(AD-A022101; SU-SOL-75-26; ARO-12215-9-M) Avail: NTIS CSCL 05/1

The report presents an algorithm for solving a form of the resource constrained project scheduling problem. This particular form of the problem differs from that usually considered in that the time needed to complete a job depends on the amount of resources applied to that job. Jobs are preemptable and the objective is to minimize the project duration. It is shown that this problem is equivalent to the problem of finding that transportation polytope, defined by the resource constraints, of minimal dimension which has a face specified by the precedence constraints. A theorem is presented which gives conditions under which a face of a specified type exists. Using this theorem, the problem transforms into an integer programming problem with variables representing the completion times for each job. The constraint set is defined by inequalities involving addition and maximum operations on the variables and, without the constraint that the variables be integer, the constraint set forms a nonconvex, polyhedral set. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N76-31062# Defense Documentation Center, Alexandria, Va.
SOURCE HEADER LIST Report for period ending 24 Feb. 1976
Mar. 1976 774 p Supersedes DDCH-4185.4
(AD-A022150; DDC-TR-76-2; DDCH-4185.4) Avail: NTIS CSCL 05/2

Source names used by the Defense Documentation Center in the Research and Technology Work Unit Information System, and the Technical Report, Program Planning, and Independent Research and Development Data Banks are compiled alphabetically. Each source name is assigned a 6-digit numeric code for computer input and retrieval, a 4-digit alphanumeric geopolitical code and a 1-digit alphanumeric type code. As of 24 February 1976, there are 23,505 source codes assigned. Author (GRA)

N76-31063# Lane County Government, Eugene, Oreg.
MESSAGES AND CODES MANUAL: A DESCRIPTION OF TCDMS MESSAGES AND RETURN CODES
25 Nov. 1975 195 p
(Contract HUD-H-2073)
(PB-251346/3; USAC-LCG2-0013) Avail: NTIS HC $7.50 CSCL 13B

This manual is from a USAC series produced by the Lane County Regional Information Systems Department. It contains a description of each telecommunications data management system message and return code produced by TCDMS during execution of system tasks, utilities, and user application programs. GRA

N76-31064# City of Reading, Pa.
USER MANUAL FOR GEOGRAPHIC BASE MAINTENANCE
May 1975 94 p ref
(Contract HUD-H-1212)
(PB-251310/9; USAC-RPA5-7035) Avail: NTIS HC $5.00 CSCL 13B

This report is from a series produced by the city of Reading covering activities from systems analysis through implementation and evaluation of urban information systems. This document signals completion of the orientation and training (O and T) effort for the Geographic Base Maintenance Module. This document is intended to provide explicit instructions for input, correction and report procedures of the Standard Permit Processing Module, as well as an overview of its scope within the Reading Integrated Municipal Information System. GRA

N76-31065# Pennsylvania State Univ., University Park. Inst. for Research on Human Resources.
DESIGN AND EVALUATION OF A UNIVERSITY-BASED SCIENTIFIC AND TECHNICAL INFORMATION CLEARINGHOUSE FOR THE PENNSYLVANIA GENERAL ASSEMBLY Final Report
Irwin Feller Jan. 1976 62 p refs
(Grant NSF ISR-74-22863)
(PB-252312/4; NSF/RA-760046) Avail: NTIS HC $4.50 CSCL 05B

A pilot project is reported to establish a clearinghouse for Scientific and Technical Information for the Pennsylvania General Assembly. The activities of the Center for the Study of Science Policy in implementing the clearinghouse are summarized. The overall performance of the clearinghouse project, designed to test a faculty based model of technical assistance to a state legislature, was mixed, and the report seeks to derive lessons on faculty legislative relationships from the experiment. GRA

N76-31066# Computer Horizons, Inc., Cherry Hill, N. J.
EVALUATIVE BIBLIOMETRICS: THE USE OF PUBLICATION AND CITATION ANALYSIS IN THE EVALUATION OF SCIENTIFIC ACTIVITY
Francis Narin 31 Mar. 1976 460 p refs
(Contract NSF C-627)
(PB-252339/7) Avail: NTIS HC $12.00 CSCL 05B

The bibliometric path of publications and citation counts as tools for the librarian, and an evaluation path using these tools to illuminate scientific activity, are studied. This monograph is structured to provide an insight into three major aspects of evaluative bibliometrics: the historical development, the correlation of bibliometric and non-bibliometric measures, and some operational limitations. Also considered are the influence of this methodology and closely related current applications. GRA

N76-31067# British Library Lending Div., Boston Spa (England).
BATH UNIVERSITY COMPARATIVE CATALOGUE STUDY. PAPER 1: THE BACKGROUND TO BUCCS Final Report
Philip Bryant Jun. 1975 74 p refs
(BLL-BLRDR-5240-(2113.56F)P-1; BATH/BUCCS/1) Avail: British Library Lending Div., Boston Spa, Engl.

The philosophy and development of the Bath Mini-Catalogue is outlined. Brief details are provided about the University of Bath, its siting, planning, and academic pattern. General background data is also given about the University Library, such as its layout, staffing establishment, and opening hours. The card catalogue (UDC classified with name and subject indexes), and the use of the classification is described in detail. Author

N76-31068# British Library Lending Div., Boston Spa (England).
BATH UNIVERSITY COMPARATIVE CATALOGUE STUDY. PAPER 2: METHODOLOGY Final Report
Angela Needham, Susan Morris, and Philip Bryant Mar. 1975 89 p refs
(BLL-BLRDR-5241-(2113.56F)P-2; BATH/BUCCS/2) Avail: British Library Lending Div., Boston Spa, Engl.

The methods are described by which the performance of the four orders: name, UDC classified, title and KWOC, and the four physical forms: card, printout, COM rollfilm and COM fiche, was compared. The methodology identifies the variables which had to be considered and the controls used, and was designed primarily to ascertain speed of access and likely success of retrieval at each of the four forms. A similar design is outlined for testing alternative versions of rollfilm output, and also for comparing UDC classified catalogues in several institutions. The analyses used to provide information on the performance of the forms and orders are outlined. Author

N76-31069# British Library Lending Div., Boston Spa (England).
BATH UNIVERSITY COMPARATIVE CATALOGUE STUDY. PAPER 3: PERFORMANCE OF FOUR PHYSICAL FORMS OF CATALOGUES Final Report

Angela Needham May 1975 84 p refs
(BLL-BLRDR-5242-(2113.56F)P-3; BATH/BUCCS/3) Avail: British Library Lending Div., Boston Spa, Engl.

The results obtained from the controlled experiments to investigate the performance of the four physical forms of catalogue are given. Only the time for card is significantly slower and this is partly the result of the absence of KWOC and Title orders in that form. Search times obtained during interviews, both before and after the removal of the card and printout forms, are also given. Reasons for differences in performance between different groups of users are discussed. Teaching staff were the slowest, regardless of form. The physical form used did not affect the search time of senior library staff. The COM forms proved quicker than card or printout for the more difficult questions. The conclusion is that the physical form used is not a significant factor in determining speed of access. Author

N76-31070# British Library Lending Div., Boston Spa (England).
BATH UNIVERSITY COMPARATIVE CATALOGUE STUDY. PAPER 4: CATALOGUES ON ROLLFILM Final Report
Angela Needham and John Spencer Jun. 1975 45 p refs
(BLL-BLRDR-5243-(2113.56F)P-4; BATH/BUCCS/4) Avail: British Library Lending Div., Boston Spa, Engl.

Indexed, unindexed, mechanized, and handwound cassetted rollfilm were compared for catalogue use. User preference and speed of search are emphasized. Results are discussed. Author

N76-31071# British Library Lending Div., Boston Spa (England).
BATH UNIVERSITY COMPARATIVE STUDY. PAPER 5: PERFORMANCE OF FOUR ORDERS OF CATALOGUE Final Report
Angela Needham Jun. 1975 35 p refs
(BLL-BLRDR-5244-(2113.56F)P-5; BATH/BUCCS/5) Avail: British Library Lending Div., Boston Spa, Engl.

The results obtained by panel members at each order are discussed. The students success rates indicate the name and title catalogues about equal, but the KWOC is 20% more successful than the classified catalogue. There is much less difference for senior library staff between success rates and average search times at classified and KWOC. The teaching staff also had no greater difficulty in finding material in the classified catalogue than in the KWOC, although they preferred the latter. The performance of each order at the different physical forms is analyzed. Author

N76-31072# British Library Lending Div., Boston Spa (England).
BATH UNIVERSITY COMPARATIVE CATALOGUE STUDY. PAPER 6: CLASSIFIED OR KWOC CATALOGUES Final Report
Angela Needham Jun. 1975 45 p refs
(BLL-BLRDR-5245-(2113.56F)P-6) Avail: British Library Lending Div., Boston Spa, Engl.

The KWOC catalogue at Bath University was produced initially as an 'extended title' catalogue. The BUCCS project showed it was preferred to the UDC classified catalogue for most subject searches. The completed questionnaires and surveys showed a heavy use of this order and analysis revealed that 31% of the control panel used KWOC as their first choice when carrying out their own searches. Experiments were carried out with UDC catalogues at three similar universities to see if the Bath results would apply generally. Success rates were in all cases lower than that obtained at the KWOC catalogue. It is concluded that the KWOC catalogue is quicker and potentially more successful than a UDC classified catalogue, at least in the scientific and technological fields tested. Author

N76-31073# British Library Lending Div., Boston Spa (England).
BATH UNIVERSITY COMPARATIVE CATALOGUE STUDY. PAPER 7: COSTING DIFFERENT FORMS OF LIBRARY CATALOGUES Final Report
Philip Bryant and Angela Needham Jun. 1975 26 p refs
(BLL-BLRDR-5246-(2113.56F)P-7) Avail: British Library Lending Div., Boston Spa, Engl.

Areas of work which need to be costed are identified. For the purpose of the figures given it is assumed that each catalogue has reached a certain point in its development, the cost or value at that point is calculated, and also the additional cost for the necessary updating over a period of seven years. At year 1 each catalogue contains entries for 70,000 items and at year 7 this figure is assumed to have doubled to 140,000 items. Author

N76-31074# British Library Lending Div., Boston Spa (England).
BATH UNIVERSITY COMPARATIVE CATALOGUE STUDY. USER REACTIONS TO VARIOUS FORMS AND ORDERS OF CATALOGUES Final Report
Angela Needham Nov. 1974 65 p refs
(BLL-BLRDR-5247-(2113.56F); BATH/BUCCS/8) Avail: British Library Lending Div., Boston Spa, Engl.

All the BUCCS panel members were interviewed immediately after they had completed their final round of controlled searches. The interviews were tape recorded. The notes giving guidance to the four interviewers, who were the persons who actually timed the panel members concerned, are given as an Appendix. The aim was to prompt the panel into discussing their reactions, comments, criticisms, preferences, etc. in as much detail as they felt able to do. The comments are listed in full and statistically analyzed. A 'weighting' system was devised to take into account second choices and positive dislikes. The students' preferred form was fiche, the teaching and library staff preferred printout. Reaction to the KWOC catalogue was very favorable, and it was preferred to the classified catalogue for most subject searches. Author

N76-31075# British Library Lending Div., Boston Spa (England).
BATH UNIVERSITY COMPARATIVE CATALOGUE STUDY. PAPER 9: INCIDENTAL DISCOVERIES OF THE BUCCS PROJECT Final Report
J. H. Lamble, Philip Bryant, and Angela Needham Jun. 1975 41 p refs
(BLL-BLRDR-5248-(2113.56F)P-9; BATH/BUCCS/9) Avail: British Library Lending Div., Boston Spa, Engl.

Details of who uses the library and how often, and the frequency of catalogue use are given. Of particular interest was the positive response of the panel members to the learning they gained as a result of carrying out controlled searches at the catalogue. The questionnaires and the surveys provided data on the kinds of information which users brought to the catalogue, and the way in which they used that information. Users indicated what data included in the catalogue entries was most likely to affect their choice of items, and what they did when they failed to find what they were looking for. Reasons for not using the catalogue were also sought during the surveys. Author

N76-31076# British Library Lending Div., Boston Spa (England).
BATH UNIVERSITY COMPARATIVE CATALOGUE STUDY. PAPER 10: THE BUCCS PROJECT, CONCLUSIONS AND RECOMMENDATIONS Final Report
J. H. Lamble, Philip Bryant, and Angela Needham Jun. 1975 34 p refs
(BLL-BLRDR-5249-(2113.56F)P-10; BATH/BUCCS/10) Avail: British Library Lending Div., Boston Spa, Engl.

No statistically significant differences in search times, or success rates, were found between the three computer-produced catalogues. The card catalogue was slower, partly - but not entirely - due to the absence of KWOC and title orders in that form. It was also the least successful in all sequences except the classified. Users indicated a strong preference for fiche with printout the most likely second choice. The additional experiment carried out in liaison with NRCd showed that motorized readers and indexed rollfilm did not improve quantitative performance, but this variant was preferred to handwound readers and unindexed film. The comparison of the different orders showed KWOC more likely to be successful than the classified or title catalogue. There was little difference in the success rates of name and title orders. Author

N76-31077# British Library Lending Div., Boston Spa (England).
AUTOMATED LIBRARY PROCESSES AND INTERDISCIPLINARY INFORMATION STUDIES. PART 3: INTERDISCIPLINARY INFORMATION STUDIES
P. M. Linn Sep. 1975 47 p refs
(BLL-BLRDR-5252-(2113.56F)Pt-3; LUT/LIB/R11-Pt-3) Avail: British Library Lending Div., Boston Spa, Engl.

Magnetic tape merging problems in the event of using subset tapes instead of primaries or SDI printout to build and run an interdisciplinary information service were studied. Problems of

source coverage, broad profile development and aids, tape and logical format reconciliation, duplicate elimination, merging of subsets to form a searchable interdisciplinary file, utilization, and some costing matters were examined. Utilization studies included search across different indexing policies and the services feasible from merged files. It is concluded that merged bases, formed from subsets of complete bases per subject, could provide the only effective means of approaching reasonable coverage of interdisciplinary fields, while avoiding the use of extensive resources on primary sources. Author

N76-31078# British Library Lending Div., Boston Spa (England).
AUTOMATED LIBRARY PROCESSES AND INTERDISCIPLINARY INFORMATION STUDIES. PART 2: AUTOMATED LIBRARY PROCESSES APPLICATIONS OF THE PLESSEY DATA CAPTURE UNIT Final Report, Mar. 1973 - Jun. 1975
R. A. Wall and M. E. Robinson Sep. 1975 117 p
(BLL-BLRDR-5251-(2113.56F)Pt-2; LUT/LIB/R10-Pt-2) Avail: British Library Lending Div., Boston Spa, Engl.

The library applications of a transportable Plessey unit, in association with other projects, was investigated. The uses envisaged were: (1) automated Serials Accession (intended as a pilot experiment which might result in a further contribution to MASS at BLCMP, the MARC-based Automated Serials System); (2) on-line or batch indexing or retrieval via reading of thesaurus codes with the Plessey equipment (intended to supplement the Interdisciplinary Information Studies project (IIS)). Author

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N76-31079*# United Air Lines, Inc., San Francisco, Calif.
STUDY OF COST/BENEFIT TRADEOFFS FOR REDUCING THE ENERGY CONSUMPTION OF THE COMMERCIAL AIR TRANSPORTATION SYSTEM
Richard E. Coykendall, John K. Curry, Albert E. Domke, and Sven E. Madsen Jun. 1976 194 p refs
(Contract NAS2-8625)
(NASA-CR-137891) Avail: NTIS HC $7.50 CSCL 05C

Economic studies were conducted for three general fuel conserving options: (1) improving fuel consumption characteristics of existing aircraft via retrofit modifications; (2) introducing fuel efficient derivations of existing production aircraft and/or introducing fuel efficient, current state-of-the-art new aircraft; and (3) introducing an advanced state-of-the-art turboprop airplane. These studies were designed to produce an optimum airline fleet mix for the years 1980, 1985 and 1990. The fleet selected accommodated a normal growth market by introducing somewhat larger aircraft while solving for maximum departure frequencies and a minimum load factor corresponding to a 15% investment hurdle rate. Fuel burnt per available-seat-mile flown would drop 22% from 1980 to 1990 due to the use of more fuel efficient aircraft designs, larger average aircraft size, and increased seating density. An inflight survey was taken to determine air traveler attitudes towards a new generation of advanced turboprops. Author

N76-31080# RAND Corp., Santa Monica, Calif.
A CRITIQUE OF COST-EFFECTIVENESS
E. S. Quade Nov. 1975 9 p refs Presented at the Session on Cost-effectiveness, ORSA/TIMS, Las Vegas, Nev., 17 Nov. 1975
(AD-A022195; P-5524) Avail: NTIS CSCL 14/1

It is important that a decision take into account all the relevant information whether or not this information lends itself to inclusion in formal analysis. All forms of analysis have their virtues and drawbacks. None can take into consideration or present all the information. A single cost-effectiveness calculation leaves out a great deal but it does emphasize the aspects that are usually the most important and of greatest interest to the decisionmaker. It gives excellent results provided the alternatives are reasonably similar and seek the ultimate goal through the same target so that their effectiveness in attaining that target can be measured on the same scale. Cost-benefit analysis can take into account many more aspects of a decision but it does so at the expense of emphasis and through a great deal of heroic quantification that is extremely arbitrary and, where values are concerned, is based on the judgment of the wrong people. Multiple cost-effectiveness calculations, including some that do not translate all costs into monetary units obviously go farther in taking things into account than the traditional single comparison that we often think of when we say cost-effectiveness analysis. It has the additional advantage that it not only forces the judgment on the right people but calls their attention to which judgments are needed. GRA

N76-31081# Naval Postgraduate School, Monterey, Calif.
THE A-7 ALOFT COST MODEL: A STUDY OF HIGH TECHNOLOGY COST ESTIMATING M.S. Thesis
Ronald Lloyd Johnson and Earle William Knobloch Dec. 1975 274 p refs
(AD-A021913) Avail: NTIS CSCL 14/1

This analytical study contains the development of an appropriate life cycle cost (LCC) model for the A-7 Airborne Light Optical Fiber Technology (ALOFT) system. The model was developed to support an A-7 ALOFT economic analysis which will compare the total systems costs and performance benefits of an A-7 fiber optic linked navigation and weapons delivery system to existing or proposed wire interconnect designs. Major features of this study include the development of: (1) a process to derive cost estimates of a high technological development in the early conceptual stage; (2) an appropriate LCC model for the A-7 ALOFT economic analysis; and (3) fiber optic costing methodology to support the LCC analysis. This analysis is a follow-on study to An Approach to the Estimation of Life Cycle Costs of a Fiber Optic Application in Military Aircraft AD-A019 379. GRA

N76-31082# Bureau of Economic Analysis, Washington, D. C.
READINGS IN CONCEPTS AND METHODS OF NATIONAL INCOME STATISTICS
5 Apr. 1976 342 p Revised
(PB-251329/9; BEA-SUP-76-02) Avail: NTIS HC $10.00 CSCL 05C

The basic conceptual structure of the national income and product statistics first published in 1954 are reprinted in this publication, along with revisions introduced in 1958, 1965, 1974 and 1976. The statistical procedures, their modifications and extensions, are also covered. How GNP is deflated is discussed in detail in a paper published in 1967. Revisions in deflation procedures introduced in 1974 and 1976 are also included in this publication. GRA

N76-31083# Federal Trade Commission, Washington, D.C. Bureau of Competition.
RATES OF RETURN IN SELECTED MANUFACTURING INDUSTRIES 1964-1973
1976 80 p
(PB-252246/4; FTC-RR-73) Avail: NTIS HC $5.00 CSCL 05C

Rates of return for identical companies in selected manufacturing industries are compared for the 10-year period, 1964-1973. The report continues the financial data for a wider industry coverage by including rates of return for the 12 largest companies in each of 33 selected industries. Comparative rates of return for 1970 and 1971, for identical companies are presented for the 4 largest companies; and if possible, the second 4 and third 4 largest companies, in each of the 33 industries, so that more representative financial data may be provide for companies in more specific industries. GRA

N76-31084# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A MONTE CARLO RISK ANALYSIS OF LIFE CYCLE COST PREDICTION M.S. Thesis
Samuel B. Graves Sep. 1975 188 p
(AD-A021677; GOR/SM/75D-6) Avail: NTIS CSCL 15/5

This study is an investigation of the uncertainties involved in the prediction and measurement of Life Cycle Costs. The particular treatment here analyzes Logistic Support Costs, which

are a subset of the Life Cycle Costs. The Logistics Supportability Incentives which are embodied in the current General Dynamics F-16 contract are analyzed in the light of the stochastic uncertainties of prediction and measurement of Logistic Support Cost. A Monte Carlo Simulation model is developed which will approximate the uncertainties involved in obtaining a sample measurement of Logistic Support Cost in a fixed length test. The model output is applied to the problems of determining appropriate contractor rewards or penalties, investigating the feasibility of contractor strategies, and investigating the effect of various test lengths. GRA

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N76-31085# Committee on Science and Technology (U. S. House).
NASA AUTHORIZATION, 1977, VOLUME 2, PART 2
Washington GPO 1976 579 p Hearings on H.R. 11573 (superseded by H.R. 12453) before subcomm. on Aviation and Transportation R and D of Comm. on Sci. and Technol., 94th Congr., 2d Sess., 10-11 Feb. 1976
(GPO-69-739) Avail: Subcomm. on Aviation and Transportation R and D

Testimony is given on NASA programs for FY 1977 as they relate to the proposed budget. Specific topics discussed include: technology for the long-range flight regime; technology for the high-speed flight regime; technology for the low-speed flight regime; aircraft environmental minimization program; aircraft operations and safety; and general aviation. J.M.S.

N76-31086# Committee on Science and Technology (U. S. House).
NASA AUTHORIZATION, 1977, VOLUME 3
Washington GPO 1976 433 p Hearing on H.R. 11573 (superseded by H.R. 12453) before Comm. on Sci. and Technol., 94th Congr., 2d Sess., 27 Jan. 1976
(GPO-69-812) Avail: Comm. on Sci. and Technol.

Various NASA programs are discussed in terms of the proposed budget for FY 1977. These include: space shuttles; science and applications; energy efficient aircraft; development of energy technology in the areas of solar heating and cooling; electric power generation by wind power; applications of photovoltaic cells; application of NASA technology to national problems; tracking and data relay satellite system; thematic mapping; MAGSAT; the solar maximum mission; and the national transonic facility. J.M.S.

N76-31087# Committee on Science and Technology (U. S. House).
AUTHORIZING APPROPRIATIONS TO THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Washington GPO 1974 185 p Rept. to accompany H.R. 4700 for Comm. on Sci. and Technol., 94th Congr., 1st Sess., 14 Mar. 1974
(H-Rept-94-63) Avail: US Capitol, House Document Room

A bill to authorize appropriations to the National Aeronautics and Space Administration for FY 1976 is presented. Programs discussed include research and development, construction of facilities, and research program management. J.M.S.

N76-31088# Committee on Science and Technology (U. S. House).
AUTHORIZING APPROPRIATIONS TO THE NATIONAL SCIENCE FOUNDATION
Washington GPO 1975 154 p Rept. to accompany H.R. 4723 for Comm. on Sci. and Technol., 94th Congr., 1st Sess., 14 Mar. 1975
(H-Rept-94-66) Avail: US Capitol, House Document Room

The authorization bill for appropriations to the National Science Foundation for FY 1976 is presented. Research and educational support are emphasized. J.M.S.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N76-31089 Washington Univ., Seattle.
ACTIVATED CARBON ADSORPTION IN MUNICIPAL WASTEWATER TREATMENT AND REUSE SYSTEMS Ph.D. Thesis
David Kamching Chow 1975 199 p
Avail: Univ. Microfilms Order No. 76-17431

Experimentally, fixed beds of activated carbon were set up to treat biological and chemical secondary effluents from the same source of municipal sewage. Water in the adsorption effluents was evaporated under reduced pressure to achieve a rapid buildup of the resistant compounds and to prevent the destruction of heat-sensitive compounds. The nature of the resistant compounds thus obtained was investigated by various physical and chemical analytical techniques, with prime concern being the classification of both organic and inorganic compounds. Since the concentrated adsorption effluents were often recycled to the carbon beds, breakthrough data were grouped into two categories. General breakthrough characteristics, such as breakpoint time and adsorptive capacity, were examined. Data were compared with general theoretical expressions.
Dissert. Abstr.

N76-31090*# Aerospace Corp., El Segundo, Calif. Energy and Transportation Div.
EFFECT OF AIRCRAFT TECHNOLOGY IMPROVEMENTS ON INTERCITY ENERGY USE Final Report
May 1976 108 p
(Contract NAS2-6473)
(NASA-CR-137940; ATR-76(7310)-1) Avail: NTIS HC $5.50 CSCL 13F

An examination of the growth or decline in energy consumption in short haul, high density intercity transportation is made in relation to changes in aeronautical technology. Improvements or changes in the technology of competitive modes are also included. Certain improvements in air traffic control procedures were included to determine their effectiveness in saving energy along with a fuel efficient turboprop short haul aircraft concept.
Author

N76-31091# Verve Research Corp., Bethesda, Md.
FORECAST OF LANDSIDE AIRPORT ACCESS TRAFFIC AT 211 MAJOR US AIRPORTS TO 1990. VOLUME 1: THE FORECASTS Final Report
William W. Ellis, Naomi C. Booker, and Irene S. Feldstein Feb. 1976 243 p refs
(Contract DOT-FA74WAI-449)
(AD-A025401/1; FAA-RD-75-124-Vol-1; VR-19-5) Avail: NTIS HC $8.00 CSCL 01/5

Landside airport access traffic is forecast for 211 major U. S. airports for 1975, 1980, 1985, and 1990. The 1973 traffic is estimated. Aspects of access traffic forecast are average daily total vehicular volume, peak hour volume per lane of principal access roadway, congestion status, modal split (including auto, taxi/limousine, bus, rail, and other), and annual access traveler volume.
Author

N76-31092# Verve Research Corp., Bethesda, Md.
FORECAST OF LANDSIDE AIRPORT ACCESS TRAFFIC AT MAJOR US AIRPORTS TO 1990. VOLUME 2: DETAILED TECHNICAL DESCRIPTION OF FORECASTING METHODS Final Report
William W. Ellis, Naomi C. Booker, and Irene S. Feldstein Feb. 1976 76 p refs
(Contract DOT-FA74WAI-449)
(AD-A025246/0; VR-19-5-Vol-2; FAA-RD-75-124-Vol-2) Avail: NTIS HC $5.00 CSCL 01/5

The methods used to forecast key aspects of landside access

traffic are described. The volume includes an overview of the work, a detailed description of the forecasting procedures, a synopsis of earlier unpublished project reports, and an annotated bibliography of relevant works. Author

N76-31093*# InterAmerica Research Associates, Washington, D.C.
TECHNOLOGY UTILIZATION CONFERENCE SERIES, VOLUME 1 Final Report
19 Dec. 1975 50 p
(Contract NASw-2761)
(NASA-CR-148714) Avail: NTIS HC $4.00 CSCL 05A

The design, development, and results of a series of technology utilization conferences are presented. The conference series represents the development of a viable and successful means of encouraging the transfer of technology to the minority business community. Author

N76-31094*# InterAmerica Research Associates, Washington, D.C.
TECHNOLOGY UTILIZATION CONFERENCE SERIES, VOLUME 2 Final Report
27 Feb. 1975 294 p
(Contract NASw-2761)
(NASA-CR-148715) Avail: NTIS HC $9.25 CSCL 05A

Proceedings of a series of technology utilization conferences are presented. Commercial applications of space technology, machine tool and metal fabrication, energy and pollution, and mechanical design are among the topics discussed. Emphasis is placed on technology transfer and the minority businessman. J.M.S.

N76-31095*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MODULAR DISPOSABLE CAN (MODCAN) CRASH CUSHION: A CONCEPT INVESTIGATION
A. Knoell and A. Wilson 15 Aug. 1976 27 p refs
(Contract NAS7-100)
(NASA-CR-148757; JPL-TM-33-795) Avail: NTIS HC $4.00 CSCL 13F

A conceptual design investigation of an improved highway crash cushion system is presented. The system is referred to as a modular disposable can (MODCAN) crash system. It is composed of a modular arrangement of disposable metal beverage cans configured to serve as an effective highway impact attenuation system. Experimental data, design considerations, and engineering calculations supporting the design development are presented. Design performance is compared to that of a conventional steel drum system. It is shown that the MODCAN concepts offers the potential for smoother and safer occupant deceleration for a larger class of vehicle impact weights than the steel drum device. Author

N76-31096# National Science Foundation, Washington, D.C. Office of Intergovernmental Science and Research Utilization.
TECHNOLOGY AND THE CITIES. PARTNERS FOR PROGRESS
D. W. Gottlieb 1975 76 p refs
(PB-252357/9; NSF/RA/G-75-018) Avail: NTIS HC $5.00 CSCL 13B

A major purpose of the National Science Foundation's Research Applied to National Needs program is to shorten the gap between scientific discoveries and their application at the state and local level. Linkages between resources and the city are being developed by a variety of programs; however all involve the placement on the city manager or mayor's staff of an experienced aerospace or other high technology engineer from industry or academia as a technology adviser. In the four models that have been developed, the participating cities have produced a steady improvement in service to people. GRA

N76-31097# Cambridge Systematics, Inc., Mass.
A STUDY DESIGN FOR DUAL MODE PLANNING CASE STUDY
E. R. Ruiter, G. A. Kocur, and D. G. Stuart 20 Mar. 1975 204 p refs Prepared in cooperation with Barton-Aschman Associates, Inc.
(Contract DOT-UT-40018)
(PB-250476/9; UMTA-MA-06-0056-75-1; UTP-CSI.75.1.4) Avail: NTIS HC $7.75 CSCL 13B

A detailed description of the individual project tasks and subtasks is given. The tasks emphasize both the need to represent dual mode as a new transportation technology with many uncertainties as to its characteristics; and the need to consider the goals, objectives, and socioeconomic and trip making characteristics of the local area. In addition, the document also contains cost allocations, time schedules, organizational arrangements and management control procedures for the conduct of the project. GRA

N76-31098# Kusko (Alexander), Inc., Needham Heights, Mass.
A SURVEY OF PROPULSION SYSTEMS FOR HIGH CAPACITY PERSONAL RAPID TRANSIT Final Report, Jul. 1974 - Jun. 1975
Thorleif Knutrud Jul. 1975 110 p refs
(Contracts DOT-TSC-203; DOT-TSC-965)
(PB-250581/6; UMTA-MA-06-0048-75-2; DOT-TSC-UMTA-75-15) Avail: NTIS HC $5.50 CSCL 13F

The high capacity personal rapid transit system must operate with very short headways. To achieve safe operation at these headways, the propulsion system should meet reversible thrust capabilities, short response time, and peak thrust exceeding three times nominal thrust. These requirements were determined by analysis, computer simulations, and data. Five propulsion systems capable of meeting these requirements have been surveyed. As background to the survey, several vehicle resistance curves were calculated for a baseline vehicle with assumed dimensions and weight. Four types of vehicle suspension methods were considered. GRA

N76-31099# Minnesota Univ., Minneapolis. School of Mechanical Aerospace Engineering.
LONGITUDINAL CONTROL AND CRASHWORTHINESS FOR SMALL AUTOMATED TRANSIT VEHICLES Final Report
W. L. Garrard, R. J. Caudill, and W. B. Reed Jan. 1976 253 p refs
(PB-251295/2; UMTA-MN-11-0037-76-1) Avail: NTIS HC $9.00 CSCL 13B

Control system designs and hardware options for relatively short headway operation at moderate speeds are evaluated. Evaluation is based on performance during normal and emergency operations, sensing and communication requirements, and simplicity of design as a measure of cost and reliability. Controllers are successfully designed for a variety of data sensing and transmission requirements and no problems are encountered in realizing constant safety factor, constant time headway, and constant spacing operational policies. Fundamental analytical results on collision dynamics and the effectiveness of passenger protective devices, shock absorbers, and interior configurations on occupant protection during fore and aft collisions are derived. GRA

N76-31100# Mitre Corp., McLean, Va.
BUS PRIORITY SYSTEMS: SIMULATION AND ANALYSIS Final Report
John S. Ludwick Feb. 1976 36 p refs
(Contract DOT-UT-50016)
(PB-251246/5; MTR-7146; UMTA-VA-06-0026-76-1) Avail: NTIS HC $4.00 CSCL 13B

A number of techniques were simulated that give buses priority over other traffic by preempting traffic signals as buses approach an intersection. An unconditional preemption algorithm, in which the signal is changed to green and held green as long as the bus is within 200 feet upstream from the intersection, provides 25 percent travel time benefit to buses. However, the delay to cross-street traffic can be extreme, particularly at short bus headways. An algorithm limiting the preemption to a maximum of 10 seconds provides 20 percent bus travel time improvement with only 7 percent cross-street travel time increase, even at half-minute headways. The large number of simulation runs performed has revealed factors important to the operation of such a bus priority system. GRA

N76-31101# DeLeuw, Cather and Co., Washington, D.C.
BART IMPACT PROGRAM: IMPACTS OF BART ON THE NATURAL ENVIRONMENT: INTERIM SERVICE FINDINGS

Mar. 1976 99 p refs Sponsored in part by Dept. of Housing and Urban Develop., Washington, D. C.
(Contract DOT-OS-30176)
(PB-251571/6; MTC-TM-17-4-76) Avail: NTIS HC $5.00 CSCL 13F

The impact of BART on the natural enviroment was studied. The general subject area is divided into three categories which define its limits and organize its many aspects. The categories are: (1) biota (wildlife and vegetation), (2) soils and geology; and (3) drainage and water systems. Since almost the entire area traversed by BART is urbanized and fully developed, this natural environment was not a major topic of study. However, a comprehensive review of BART's possible impacts was performed, because impacts on the natural environment are often not apparent even when they are quite significant from an ecological point of view. GRA

N76-31102# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Transportation Planning and Engineering.
ECONOMICS OF PUBLIC TRANSIT OPERATION Final Report, Sep. 1970 - Jun. 1975
Roger P. Roess, Martin F. Huss, Claire S. Kwicklis, and Robert Camoia Aug. 1975 52 p refs
(PB-251560/9; UMTA-NY-11-0009-75-1) Avail: NTIS HC $4.50 CSCL 13B

The modeling of rail rapid and bus transit operating costs for the purpose of predicting these costs for use in benefit-cost analyses is examined. Underlying parameters affecting cost are examined, including labor productivity in various categories, as measured by simple indices. Modeling techniques utilized include regression and unit cost. GRA

N76-31103# Washington Metropolitan Area Transit Authority.
AIRLIE 12 CONFERENCE
31 Jan. 1976 147 p refs Conf. held at Warrenton, Va., 29-31 Jan. 1976
(PB-251299/4; WMATA-76/1) Avail: NTIS HC $6.00 CSCL 13B

The Airlie conference highlights the financial requirements of the operating and capital programs of Metro. The following points were emphasized at the conference. Public transportation, while essential to our economic, social, and economical well-being, is a major cost and one that must be effectively managed. Rail construction costs must be kept as far as possible within the current estimate. Bus and rail operating programs must be managed so as to take advantage of every opportunity for increasing efficiency and reducing marginal service. Adequate funds are available to meet the full rail construction costs. To the extent that the full level of costs cannot be budgeted, effective budgetary alternatives must be identified without sacrificing our end program alternatives. GRA

N76-31104# National Bureau of Standards, Washington, D.C. Applied Mathematics Div.
MACHINE-READABLE MAPPING FROM NATIONAL NETWORK SIMULATION (NNS) ZONES TO BUREAU OF ECONOMIC ANALYSIS (BEA) AREAS Final Report
Daniel W. Lozier and John R. Stiehler Sep. 1975 78 p ref
(PB-251412/3; NBSIR-75-918) Avail: NTIS HC $5.00 CSCL 13B

The allocation is described of freight flow data from the National Network Simulation (NNS) zone system to the Bureau of Economic Analysis (BEA) area system. The NNS zone system was developed for use in the analysis of national modal freight flows. The BEA area system was primarily developed for the allocation of national economic data to regions of the United States. Assuming flows of commodities are known among the NNS zones, the NNS zone to BEA area mapping enables the determination of flows among the BEA areas. Zone to area mapping which utilizes 1970 economic data as the basis when an NNS zone overlaps more than one BEA area is presented along with computer programs that could be used to generate a mapping using economic data from some other year. GRA

N76-31105# Metropolitan Transportation Commission, Berkeley, Calif.
BART IMPACT PROGRAM. PUBLIC POLICY PROJECT: RESEARCH PLAN
Henry Bain and Franceen Lyons Apr. 1976 49 p
(Contract DOT-OST-30176)
(PB-251697/9; PD-22-8-76) Avail: NTIS HC $4.00 CSCL 13B

The scope of the Public Policy Project, specific research issues, and methods for performing the work are given. A theoretical framework encompassing the various anticipated public policy impacts outlines the impact process and defines the basic concepts used in formulating the research approach. The Work Elements describing the specific work to be done are closely tied to the research issues identified in the theoretical framework. Details of data collection and analysis are contained in the Work Elements. The Research Plan outlines how the work will be performed by proposing a preliminary schedule, staffing requirements, and estimates of level of effort. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N76-31106 State Univ. of New York, Stony Brook.
ASTRONOMICAL APPLICATIONS OF SPECKLE INTERFEROMETRY Ph.D. Thesis
Robert Victor Stachnik 1976 155 p
Avail: Univ. Microfilms Order No. 76-18728

Implementation of the speckle interferometry technique requires acquisition of large numbers of short exposure images, spatial power spectrum analysis, and data reduction. It is demonstrated that this process permits recovery of diffraction limited image information at large telescopes. The procedures used in image acquisition are described. The effect of the atmosphere on an astronomical image is described, and speckle interferometry is contrasted with classical long and short exposure atmospheric imaging. The effects of telescope abberations and atmospheric non-isoplanatism are discussed, as are the observed and anticipated magnitude limits of the technique. Finally, the results of speckle interferometry observations of two classes of objects, resolved stars and close binaries, are presented. The results include angular diameter and effective temperature determinations for five stars and the derivation of orbits and masses for four of the twelve close binaries observed.
Dissert. Abstr.

N76-31107 Washington Univ., Seattle.
THE EMISSION OF DWARF NOVAE Ph.D. Thesis
Paula Szkody 1975 165 p
Avail: Univ. Microfilms Order No. 76-17653

Infrared photometry, simultaneous photometry in u, b, v, and r and standard UBV r photometry were obtained for 5 dwarf novae of the U Gem and Z Cam classes (SS Cyg, RX And, Z Cam, AH Her and AB Dra). The observed magnitudes were converted to fluxes and the flux distribution over wavelength at various phases of the light cycle was compared. The infrared and visual fluxes at maximum light for SS Cyg combined with UV and X-ray data leads to a temperature of 450,000 K and a density of about 10 to the 14th power/cu cm. The flux distribution for all the novae at maximum was found to be very similar. Power spectrum analysis was applied to short time scale photometric data and a possible 35 second periodicity was found for RX And. The visual flux distribution at minimum light varied among the systems. Comparison of the observed distribution with that expected from free-free emission with various temperature hot spots and with different types of secondary stars yields the contribution of spot and secondary for each system. The

differences among the systems are suggested to be due to different mass transfer rates. Dissert. Abstr.

N76-31108*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN ATLAS OF EXTRATERRESTRIAL PARTICLES COLLECTED WITH NASA U-2 AIRCRAFT, 1974 - 1976
D. E. Brownlee (Wash. Univ.), D. Tomandl (Wash. Univ.), M. B. Blanchard, G. V. Ferry, and F. Kyte (San Jose State Univ.) Jul. 1976 48 p refs
(NASA-TM-X-73152; A-6672) Avail: NTIS HC $4.00 CSCL 03B

Extraterrestrial particles collected during U-2 flights in the stratosphere were divided into four groups: chondritic, iron-sulfur--nickel, mafic silicates, and others. The chondritic aggregates are typically composed of Fe, Mg, Si, C, S, Ca, and Ni. Detectable levels of He-4 implanted from the solar wind occur in some. Olivine, spinel, and possibly pyrrhotite and a hydrated layered-lattice silicate were indentified. The chondritic ablation particles contain no sulfur and appear to have been melted. Magnetite, olivine, and pyroxene were identified. The iron-sulfur-nickel type particles resemble meteoritic iron sulfide with a small amount of nickel, and contain magnetite and troilite. The mafic silicate type particles are iron magnesium silicate grains with clumps of chondritic aggregate particles adhering to their surfaces. Olivine and possibly pyrrhotite and pyroxene were identified. Most of the iron-nickel type particles are spherules and include taenite and wustite. The other type particles include nickel-iron mounds on spheroidal glassy-like grains having chondritic-like elemental abundances. Author

N76-31109*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE 35-D X-RAY PROFILE OF HER X-1
S. S. Holt, E. A. Boldt, L. J. Kaluzienski, P. J. Serlemitsos, and J. H. Swank Aug. 1976 8 p refs Submitted for publication
(NASA-TM-X-71174; X-661-76-182) Avail: NTIS HC $3.50 CSCL 03A

Substantial X-ray emission as reported by Ariel 5 from Her X-I midway through the extended low-state portion of its 35-day cycle is examined. A similar feature during another cycle measured from UHURU satellite is also examined. It is proposed that this feature should occur regularly, consistent with some models for the mass accretion disc which have been reported in the literature. The results of the analysis of > 500 days of Ariel-5 All-Sky Monitor data are reported which support the view that the feature occurs regularly in the 35-day cycle. Author

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N76-31110 Pennsylvania State Univ., University Park.
THE DYNAMICS OF ENTRAINMENT IN THE PLANETARY BOUNDARY LAYER: A STUDY IN TURBULENCE MODELING AND PARAMETERIZATION Ph.D. Thesis
Otto Zeman 1975 229 p
Avail: Univ. Microfilms Order No. 76-17245

The dynamics of horizontally homogeneous entraining mixed layers was studied. Parameteric and second order models of these entraining layers were developed. In the parametric model a temporal term and a dissipation term are incorporated. The effect of mechanical turbulence production at the top of the mixed layer is included as a correction to the dissipation term. Wind shear-generated turbulence is taken into account through the friction velocity and a geostrophic friction law. The second order model was developed for buoyancy-driven mixed layers. The models of pressure terms, dissipation, and destruction of temperature variance are to a great extent based on invariant techniques. The transport term models are based on solutions to the approximated rate equations for the third order turbulent moments. Buoyancy effects were taken into account. The buoyant transport model gives realistic profiles of the vertical fluxes of second-order turbulence quantities and realistic values of the downward heat flux at the top of the mixed layer.Dissert. Abstr.

N76-31111 State Univ. of New York, Stony Brook.
MASS SPECTROMETER DETERMINATIONS OF SOLAR WIND He, Ne, AND Ar AND RADIATION BELT He Ph.D. Thesis
Robert Louis Warasila 1976 140 p
Avail: Univ. Microfilms Order No. 76-18735

A mass spectrometer system was built and used to measure He, Ne, and Ar abundances and isotopic ratios in various samples of spacecraft exposed to the space environment. The Apollo 12 mission brought back sections of the Surveyor 3 vehicle suitable for mass spectrometric studies of implanted solar wind and solar cosmic ray particles. These measurements provide unique solar wind values averaged over considerably longer periods of time than the Apollo Solar Wind Composition experiments and indicate that the short term SWC measurements during a period of high solar activity may not be a reliable measure of average solar wind composition. In the radiation belt environment, He-3 was found in the aluminum antenna housing from the recovered second stage of a pre-Apollo Saturn test flight launched January 28, 1964 and returned to earth on April 28, 1966. The He-3 was shown to come from the lower radiation belt. Dissert. Abstr.

N76-31112 Maryland Univ., College Park.
CARBON AND NITROGEN ABUNDANCES IN F AND G TYPE STARS Ph.D. Thesis
Robin Edward Stevenson Clegg 1975 119 p
Avail: Univ. Microfilms Order No. 76-17785

Carbon and nitrogen abundances were obtained for a sample of eleven F and G stars. Model atmospheres, which included the effects of convection and line-blanketing, were used to calculate synthetic spectra of the CH, CN, and NH molecular bands. The stars were observed at Kitt Peak in November 1973 with the 36 inch auxiliary feed and coude spectrograph. Plates were taken in the blue and violet spectral regions and had dispersions of 9 and 13 A/mm. The overall heavy element abundances of the stars were estimated from a theoretical calibration of uvby photometry. These estimates were checked with curves of growth for neutral iron lines. Dissert. Abstr.

N76-31113 Washington Univ., Seattle.
ON THE MAXIMUM MASS OF NEUTRON STARS Ph.D. Thesis
David Robert Mikkelsen 1975 141 p
Avail: Univ. Microfilms Order No. 76-17564

Upper limits to the maximum mass of neutron stars with locally isotropic pressure are derived within the framework of general relativity and discussed. The equations of stellar structure for stars with locally anisotropic pressure are derived from the field equations of general relativity, and upper limits to the maximum mass for such stars as derived and discussed. The equations of stellar structure for stars with locally isotropic pressure are derived from the field equations of Ni's new theory of gravity. These equations are numerically integrated using a realistic equation of state, and very massive neutron stars are found to be possible within the framework of Ni's theory. An approximate, semi-analytic solution to these equations is presented. Observational determinations of neutron star radii, moments of inertia, and masses are critically discussed. Dissert. Abstr.

N76-31114 Stanford Univ., Calif.
THE POST-NEWTONIAN THEORY OF THE GENERATION OF GRAVITATIONAL RADIATION AND ITS APPLICATION TO STELLAR COLLAPSE Ph.D. Thesis
Reuben Epstein 1976 99 p
Avail: Univ. Microfilms Order No. 76-18762

Gravitational radiation from astrophysical bodies is analyzed in terms of an expansion in powers of (velocity) approximately equal to the square root of (Newtonian potential) within general relativity. Explicit expressions are obtained for the distant radiation field and the energy flux from perfect-fluid sources, valid through 3/2-post-Newtonian order (beyond the usual formulae). These results are applied to a study of the gravitational collapse of uniformly-rotating, homogeneous, pressureless stars. The stellar configuration is described in terms of the Newtonian solution plus post-Newtonian corrections, and the collapse and resulting gravitational radiation are computed. It is found that post-Newtonian collapse proceeds more slowly than Newtonian collapse and that the resulting luminosity and total energy loss

are less than that calculated for Newtonian collapse are considered The results of the numerical computations are considered to be of limited quantitative significance. Dissert. Abstr.

N76-31115*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERPLANETARY BOUNDARY LAYERS AT 1 AU
L. F. Burlaga, J. F. Lemaire (Inst. d'Aeronomie Spatiale, Brussels), and J. M. Turner (Morehouse Coll.) Jul. 1976 40 p refs Submitted for publication
(NASA-TM-X-71171; X-692-76-168) Avail: NTIS HC $4.00 CSCL 03B

The structure and nature of discontinuities in the interplanetary magnetic field at 1 AU in the period March 18, 1971 to April 9, 1971, is determined by using high-resolution magnetic field measurements from Explorer 34. The discontinuities that were selected for this analysis occurred under a variaty of interplanetary conditions at an average rate of 0.5/hr. This set does not include all discontinuities that were present, but the sample is large and it is probably representative. Both tangential and rotational discontinuities were identified, the ratio of TD's to RD's being approximately 3 to 1. Tangential discontinuities were observed every day, even among Alfvenic fluctuations. The structure of most of the boundary layers was simple and ordered, i.e., the magnetic field usually changed smoothly and monotonically from one side of the boundary layer to the other. Author

N76-31116# International Centre for Theoretical Physics, Trieste (Italy).
GENERAL RELATIVISTIC EFFECTS IN BINARY SYSTEMS
B. M. Barker and R. F. OConnell (Louisiana St. Univ., Baton Rouge) Sep. 1975 25 p refs Presented at the Enrico Fermi Summer School on Physics and Astrophysics of Neutron Stars and Black Holes, Varenna, Italy, 14 Jul. 1975
(IC-75/136; Conf-750744-3) Avail: ERDA Depository Libraries HC $3.50

A rigorous derivation of the gravitational two-body equations of motion for arbitrary masses, spins, and quadrupole moments is presented and applied to binary stellar systems. In particular, a detailed analysis of the pulsar PSR 1913+16, and its companion is carried out. Author (NSA)

N76-31117# Mons Univ. (Belgium). Dept. d'Astrophysique.
TABLES OF THEORETICAL ULTRAVIOLET FLUXES AND COLOURS, INCLUDING LINE OPACITIES
Eric Peytremann 1975 39 p refs
(Commun-47) Avail: NTIS HC $4.00

Tables of ultraviolet stellar fluxes are presented in the computation of which the opacities of a very large number of atomic lines were included. These fluxes were used to calculate magnitudes and color indices in the photometric system of the telescope on board the Dutch ANS satellite. Author (ESA)

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N76-31118 Cornell Univ., New York.
THE PHYSICS OF CLOUDS: APPLICATIONS TO OTHER PLANETS Ph.D. Thesis
William Brigance Rossow 1976 366 p
Avail: Univ. Microfilms Order No. 76-18196

The dielectric properties of H2O and H2SO4 at microwave frequencies were calculated and the properties of solutions deduced. The structure of H2O and H2SO4-H2O clouds were calculated for a well-mixed atmosphere. With COSPAR model of the Venus atmosphere, and calculated cloud models, the microwave properties of the atmosphere and clouds were compared to the 3.8 cm reflectivity of the planet, the Mariner 5 S-band occultation profile and the passive microwave emission spectrum of the planet. The physics of gravitational sedimentation, gravitational coalescence, turbulent collisions, turbulent deposition and entrainment, coagulation and condensation of aerosols is reviewed to derive order of magnitude estimates for the characteristic time scales of these processes. The time scales for these processes were compared for conditions applying to the clouds on Earth, Venus, Mars and Jupiter. An approximate technique for treating the effects of coagulation, sedimentation and turbulent mixing on the clouds of Venus was compared to more exact calculations. It is found that solving for the first three moments of the droplet size distribution is reasonably accurate. Dissert. Abstr.

N76-31119*# California Inst. of Tech., Pasadena.
MASS FRACTIONATION OF THE LUNAR SURFACE BY SOLAR WIND SPUTTERING
Z. E. Switkowski (Niels Bohr Inst., Copenhagen), P. K. Haff (Niels Bohr Inst., Copenhagen), T. A. Tombrello, and D. S. Burnett [1975] 32 p refs
(Grants NGR-05-002-333; NSF PHY-76-02724)
(NASA-CR-148779) Avail: NTIS HC $4.00 CSCL 03B

The sputtering of the lunar surface by the solar wind is examined as a possible mechanism of mass fractionation. Simple arguments based on current theories of sputtering and the ballistics of the sputtered atoms suggest that most ejected atoms will have sufficiently high energy to escape lunar gravity. However, the fraction of atoms which falls back to the surface is enriched in the heavier atomic components relative to the lighter ones. This material is incorporated into the heavily radiation-damaged outer surfaces of grains where it is subject to resputtering. Over the course of several hundred years an equilibrium surface layer, enriched in heavier atoms, is found to form. The dependence of the calculated results upon the sputtering rate and on the details of the energy spectrum of sputtered particles is investigated. It is concluded that mass fractionation by solar wind sputtering is likely to be an important phenomenon on the lunar surface. Author

N76-31120*# Martin Marietta Corp., Baltimore, Md.
PETROGRAPHIC AND PETROLOGICAL STUDY OF LUNAR ROCK MATERIALS Final Report, 22 Apr. 1975 - 21 Apr. 1976
Stephen R. Winzer Apr. 1976 50 p refs
(Contract NAS5-22363)
(NASA-CR-144791; TR-76-27C) Avail: NTIS HC $4.00 CSCL 03B

Samples returned from Apollo 14 (14171, 14305, 14319), Apollo 15 (15255), Apollo 16 (61175, 67455), and Apollo 17 (77215) were studied optically and selected polished sections by SEM/Microprobe. Splits and separates from 77215, 67455, 61175 and 15255 were prepared; 77215 and 67455 were analyzed for major, minor and LIL trace elements. The data indicate that 77215, a noritic breccia clast found in the Station 7 boulder, is a norite cumulate similar to and probably derived from the same body as 78235. The Apollo 17 boulders are found to be part of the same melt sheet, which was formed by a major impact event, possibly Serenitatis, about 4 B. Y. ago. The Apollo 14 and 16 breccias are polymict, their clast populations indicating quite different provenance. The Apollo 14 breccias are possibly the result of multiple impacts, while the other breccias studied appear to have been formed by single impacts. ANT suite clasts included in 61175 are, for the most part, granulites resulting from subsolidus recrystallization of norites, anorthosites or gabbros. This metamorphism appears to have occurred prior to the impact event forming 61175. Author

N76-31121*# Michigan Univ., Ann Arbor. Dept. of Chemistry.
Fe-57 MOESSBAUER STUDY OF TEKTITES Final Report
B. J. Evans and L. K. Leung Sep. 1976 55 p refs Submitted for publication
(Grant NGR;23-005-537)
(NASA-CR-148774) Avail: NTIS HC $4.50 CSCL 03B

Moessbauer measurements were made on selected moldavite, australite, philippinite, and Georgia tektites. The spectra consist of two apparent lines, but at least two quadrupole doublets can be fitted to these spectra. The Moessbauer parameters for these doublets indicate that they arise from Fe2+ ions with local

environments, which are relatively rich and relatively poor in calcium, respectively, similar to those in clinopyroxenes. No evidence for Fe3+/Fe2+ ratios above 0.01 (estimated detection limit) have been found in any tektite. Tektites are considerably more reduced than previously believed, and the extent of the reduction shows little or no variation among different types of tektites. These results limit the source materials of tektites to minerals in which the iron is uniformly highly reduced and in which the iron is contained clinopyroxene-like phases. Author

N76-31122# Brookhaven National Lab., Upton, N.Y.
RADIOACTIVE ISOTOPES ON THE MOON
R. Davis, Jr. 1975 17 p refs Presented at Symp. on Spallation Nuclear Reactions and their Appl. in Astrophys. and Radiotheraphy, Philadelphia, Penn., 2 May 1975 Sponsored by ERDA
(BNL-20925; Conf-750506-23) Avail: NTIS HC $3.50

A limited review of experiments and studies of radioactivity and isotope ratios in lunar materials is given. Observations made on the first few millimeters of the surface where the effects of solar flare particles are important, some measurements on individual rocks, and some studies of radioactivities produced deep in the lunar soil by galactic cosmic rays, are among the experiments discussed. NSA

N76-31123# European Space Agency, Paris (France).
METEORITES
P. Pellas Apr. 1976 18 p refs Transl. into ENGLISH of 'Planetary Space Missions', ESRO, Paris Report ESRO-SP-54, Sep. 1970 p 77-87
(ESA-TT-279) Avail: NTIS HC $3.50

The different criteria used for classification of meteorites are presented. Meteorites are divided into three main groups, stone, iron, and lithosiderites, which can be subdivided into different classes and sub-classes in accordance with chemical, mineralogical, and petrographical criteria. Thus, the stones comprise chondrites, the most frequent meteorites (93 % of observed falls), and achondrites. The chemical variations between the different categories of chondrites suggest that the solar nebula may have undergone some chemical fractionation before the parent bodies were formed. The subsequent thermal history of the parent bodies may explain the formation of achondrites. The solidification ages of meteorites, based on the Rb-Sr and U, Th-Pb methods, converge between 4.4 and 4.7 billion years. Meteorites, therefore, are the most ancient closed systems known. Author (ESA)

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N76-31124 Maryland Univ., College Park.
CHARGE STATES OF LOW ENERGY IONS FROM THE SUN Ph.D. Thesis
Richard Kevin Sciambi 1975 110 p
Avail: Univ. Microfilms Order No. 76-18716

Measurements of the ionization states and energy spectra of carbon, oxygen, and iron accelerated in 10 solar flare particle events are reported, for energies between 15 keV/nucleon and 600 keV/nucleon. These observations were made using the electrostatic energy-charge analyzer aboard the IMP-8 spacecraft. The ionization states were found to be remarkably constant from flare to flare, despite great variations in other event parameters. The mean ionization state for carbon was 5.7, for oxygen 6.2, and for iron 11.7. The time profile of the He/[C+N+O] ratio was examined, and it was found that the ratio was small early in the event, and increased with time. The energy spectra of the medium ions demonstrated a flattening below 100 keV per nucleon, which correlated with event size as measured by the event averaged flux of 130-220 keV protons. The effect of ionization energy loss on the particle spectra during this trapping is discussed, and it is found that a spectral 'kink' is expected. It is demonstrated that the observed spectral flattening is consistent with adiabatic deceleration of such 'kinked' spectra. The required value of the interplanetary diffusion coefficient is computed, and is shown to be consistent with the observations. Finally, it is shown that both the time profile of the He/(CNO) abundance ratio and its variation from event to event may be explained by the model of Nakada [1969] in terms of variable source region enrichment due to coronal thermal gradients.
Dissert. Abstr.

N76-31125*# Rice Univ., Houston, Tex. Dept. of Space Physics and Astronomy.
A MECHANISM FOR INDUCING CLIMATIC VARIATIONS THROUGH OZONE DESTRUCTION: SCREENING OF GALACTIC COSMIC RAYS BY SOLAR AND TERRESTRIAL MAGNETIC FIELDS
Joseph W. Chamberlain [1976] 28 p refs
(Grant NsG-7043)
(NASA-CR-148695) Avail: NTIS HC $4.00 CSCL 03B

A perturbation analysis, allowing for temperature and opacity feedbacks, is developed to calculate depletions in the O3 abundance and reductions of stratospheric solar heating that result from increases in NOx concentration. A pair of perturbation coefficients give the reduction in O3 and temperature through the stratosphere for a specified NOx increase. This type of analysis illustrates the tendency for various levels to self-heal when a perturbation occurs. Physical arguments indicate that the expected sign of the climatic effect is correct, with colder surface temperatures produced by reduced magnetic shielding. In addition, four qualitative reasons are suggested for thinking that significant ozone reductions by cosmic ray influxes will lead to an increased terrestrial albedo from stratospheric condensation. In this view, long-term (approximately 10,000 years) climatic changes have resulted from secular geomagnetic variations while shorter (approximately [illegible] years) excursions are related to changes in solar activity. Author

N76-31126*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MEASURES OF THE SOLAR SPECTRAL IRRADIANCE BETWEEN 1200 AND 3000 A
Donald F. Heath and Matthew P. Thekaekara Jul. 1976 37 p refs Submitted for publication
(NASA-TM-X-71172; X-912-76-171) Avail: NTIS HC $4.00 CSCL 03B

Tabulated data on solar flux measurements are presented. The measurements, taken from balloons, rockets and satellites, are not new data, but have been critically re-evaluated. The eleven year sunspot cycle is discussed. Also discussed is the brightness temperature. The effect of solar radiation at various wavelengths, on the photochemistry of stratospheric ozone is briefly discussed. J.R.T.

N76-31127# Instituto Geofisico del Peru, Lima.
SOLAR PATROL AT 9400 MHz Final Report, 1 Oct. 1970 - 30 Jun. 1975
Mutsumi Ishitsuka Dec. 1975 18 p refs
(Grant AF-AFOSR-1963-71; AF Proj. 4643)
(AD-A022707; AFGL-TR-76-0050) Avail: NTIS CSCL 03/2

Throughout the whole period covered by the grant, solar patrol observations were made at the Huancayo Observatory, at 9400 MHz with a radio polari-meter fed by a 3-foot equatorial paraboloidal antenna. These observations were carried out during three 3-hour sunshine intervals: 12-15, 15-18 and 18-21 UT, to detect and analyze outstanding solar occurrences and polarization anomalies and to measure daily flux density and circular polarization levels, respectively. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N76-31128 Maryland Univ., College Park.
MEASUREMENTS OF THE SPECTRA AND ISOTOPIC COMPOSITION OF COSMIC RAY HELIUM AND HYDROGEN NUCLEI FROM 120-235 MeV/NUCLEON Ph.D. Thesis
Harry William Leech 1975 183 p

Avail: Univ. Microfilms Order No. 76-18824

Dirrerential energy spectra of primary cosmic ray H1, H2, He3, and He4 nuclei in the energy range 120-235 MeV per nucleon were measured on a balloon flight from Thompson, Manitoba in August 1973 during a time of relatively quiet interplanetary conditions. The detector was a Geiger tube hodoscope operated in conjunction with a double dE-dx vs. E scintillation counter with resolution sufficient to resolve the isotopes of hydrogen and helium at energies not resolved by typical satellite telescopes. The Geiger tube hodoscope provided information on path length inclination and penetration coordinates in each detector enabling corrections for path length variations and nonuniformities in detector response to be made for each event. Dissert. Abstr.

N76-31129*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE STRUCTURE AND CONTENT OF THE GALAXY AND GALACTIC GAMMA RAYS. A REVIEW

Carol Jo Crannell Sep. 1976 20 p refs Summary of proceedings of the Intern. Gamma Ray Symp., Greenbelt, Md., 2-4 Jun. 1976 Submitted for publication

(NASA-TM-X-71177; X-682-76-196) Avail: NTIS HC $3.50 CSCL 03B

The International Gamma Ray Symposium entitled 'The Structure and Content of the Galaxy and Galactic Gamma Rays', held at the NASA Goddard Space Flight Center in June, 1976, is briefly reviewed. Highlights from presentations on galactic structure, discrete sources, and low energy gamma rays are described. New data and their interpretations are also summarized. D.M.L.

N76-31130*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

INFLUENCE OF A SOLAR PROTON EVENT ON STRATOSPHERIC OZONE

Donald F. Heath, Arlin J. Krueger, and Paul J. Crutzen Jun. 1976 12 p refs Submitted for publication

(NASA-TM-X-71173; X-912-76-172) Avail: NTIS HC $3.50 CSCL 03B

Ozone depletion in the stratosphere associated with the solar proton event of August 4, 1972, was observed with the backscattered ultraviolet experiment on the Nimbus 4 satellite. An abrupt ozone decrease in the 75-80 deg N zone of about 0.002 atm-cm above 4 mb was observed to persist throughout the month of August. A decrease was noted in the 55-65 deg N zone on days 219 and 220, but recovery occurred on day 221. Thereafter, a more gradual decrease was observed. The equatorial zone also showed gradual decrease after day 218, but these were not uniquely distinguished from seasonal variations. The observed change in total ozone following the event was -0.003 atm-cm for the 75-80 deg N zone, corresponding to a 1.3 percent reduction in the 0.305 atm-cm zonal average, but within the 0.019 atm-cm standard deviation. Above the 10 mb surface in the 75-80 deg N zone however, a decrease of 0.004 atm-cm may be compared with a standard deviation of 0.001 atm-cm. D.M.L.

N76-31131# Lund Univ. (Sweden). Dept. of Physics.

COMPOSITION OF MEDIUM ENERGY COSMIC RAYS FROM SILICON TO NICKEL MEASURED WITH NUCLEAR EMULSION

S. Behrnetz, K. Kristiansson, S. Lindstam, and K. Soederstroem Dec. 1975 34 p refs Sponsored by the Swed. Nat. Sci. Res. Council

(LUIP-CR-75-04) Avail: NTIS HC $4.00

The cosmic ray charge spectrum was studied in three nuclear emulsion stacks exposed in balloon flights from Fort Churchill, Canada, in 1967 and 1970. The charge region is for Z between 14 and 28 and the energy interval is about 400-800 MeV/nucleon. The particles are identified by measurements with a nuclear track photometer which is described in some detail. The charge spectrum is extrapolated to the top of the atmosphere and comparisons with other measurements are made. Special emphasis is put on the abundance ratios (Sn-Mn)/Fe, (Sc+Ti)/(V+Cr), and Ni/Fe. Author (ESA)

N76-31132# Panametrics, Inc., Waltham, Mass.

SATELLITE OV 5-6 MEASURED SOLAR PROTON EVENT ALPHA/PROTON FLUX RATIOS AND ASSOCIATED ATMOSPHERIC EFFECTS Final Scientific Report

Bach Sellers and Frederick A. Hanser Jan. 1976 35 p refs (Contract F19628-73-C-0088; AF Proj. 8600)

(AD-A021909; AFCRL-TR-76-0025) Avail: NTIS CSCL 20/8

The time dependence of satellite OV5-6 measured proton and alpha fluxes has been determined for a series of events in the 1969-73 descent period of solar cycle 20. These fluxes have been used to investigate the variation of the alpha/proton flux ratio both within a given event and from event-to-event. An approximate relationship between riometer absorption and the square root of proton flux (above a threshold energy of 2.2 MeV) for nighttime PCA conditions is presented which is similar to that previously used for day conditions. By use of a new formulation the proton fluxes are used to make an accurate calculation of the absorption and this is compared with both the approximate and measured values. Also discussed are possible uses of alpha/proton measurements made soon after event onset for later time predictions, in particular the time evolution of absorption. Author (GRA)

99 GENERAL

N76-31133# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.

[ACTIVITIES OF THE MAX-PLANCK-INSTITUTE FOR EXTRATERRESTRIAL PHYSICS] Annual Report, 1975 [TAETIGKEITSBERICHT 1975]

1976 234 p refs In GERMAN

Avail: NTIS HC $8.00

Research is reported in the fields of the magnetosphere, interplanetary space, infrared astronomy, X-ray astronomy, gamma astronomy, and ultraviolet measurements. ESA